THE

ELECTRICAL REVIEW.

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THE

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ELECTRICAL DISTRIBUTION BY ALTERNATING CURRENTS.

WE have received a communication relating to an alleged new and improved system of working alternating current sub-stations, whereby the transformers are, by means of an automatic switching arrangement, cut out or in as the load decreases or increases, the object being to save the magnetising current in the idle transformers during the time of light loads.

It must be understood that the automatic switch and other arrangements suggested in the communication referred to, and for which so many advantages are claimed, have not yet been put to the only tests the results of which could support or disprove the somewhat extravagant views adduced in support of the proposed improvements. Inventors and their friends are always apt to fall into the error of making such claims *before* a trial, but the only safe plan to prevent loss, disappointment, and trouble, is to reserve such claims until rigorous and thorough practical tests have been made. It is so easy to boast about inventions before a trial, yet how often do we discover that there is nothing to boast of after it. In the earlier central station plants the customers were few and far between, consequently each customer required his own transformer, and these transformers were connected to the primaries all the time, and further, the transformers required a pretty large magnetising current, so that the load was considerable during the day. This all-day load was not the same in every system; it depended altogether on the skill and care expended in the construction of the transformers.

It was recognised by many engineers that something must be done to reduce the all-day losses arising from the primary current running to waste when no demand for lighting existed, and there were two courses open with this object in view: first, to reduce the amount of the magnetising current to a negligible quantity, and secondly, to arrange an automatic switch to cut the transformers in and out. Mr. James Swinburne attacked the problem some years ago, and pursuing the first course, produced the "Hedgehog" transformer, which takes a very small magnetising current at no load. Whether it solved the problem or not does not concern us now; Mr. Swinburne's arguments and statements directed attention to the point, and strenuous endeavours have ever since been made by the scientific constructors and designers of transformers to reduce the magnetising current at no load to such an amount that it is negligible, and we believe the leading electrical engineers in the alternating current business have been successful in producing transformers in which the loss due to magnetising current at no load is not more than 1 per cent. of the full load, and many of the older transformers are at present being replaced by those of the more economical construction. This method of meeting

the difficulty is thoroughly rational, and a sign of good engineering common sense.

The other course is only a makeshift, and only necessary where poor transformers are employed. It does not go to the root of the evil, but attempts to mitigate it by introducing further mechanisms and complications, all of which are liable to failure, and besides adding to the first cost, it also adds to the cost of maintenance.

This system comes a little late in the day, for similar schemes have been fully considered, discussed, and abandoned long ago, and numerous patents, embodying every kind of switching and other arrangements for the same purpose, have been laid aside as worthless. Such arrangements are all open to the insurmountable objection that they employ pieces of moving machinery required to act infallibly at a distance from the central station. Moving mechanism is not infallible, and requires attention regularly, and, in any case, no automatic switch could be accepted for the purpose unless its absolute reliability in actual work had been for a long time practically demonstrated in an actual working installation. It has been decided by competent engineers that the money spent on cut-out automatic switches, and other proposed arrangements, is far more profitably spent in improving the transformers and replacing the older wasteful apparatus by the new, improved, and economical forms.

And, further, the scattered small transformer system, erroneously styled by some people "the house-to-house system," is a thing of the past. It never was a house-to-house system, but a system of scattered isolated plants, each using its own transformer, taking the magnetising current all the time, and the losses were great for the reason that the transformers used were badly designed and constructed.

The adoption of the compulsory area lighting by corporations, and the selection of districts wherein the consumers are bunched together, has developed the sub-station, where the transformers are arranged in banks, and the consumers are now supplied in a true house-to-house method by connecting each to the common secondary main from the sub-station.

Now-a-days, at these sub-stations the best of transformers are put down. There is no monopoly in transformers; the best wins in this case, and makers who cannot guarantee a certain efficiency at the various loads simply "get left," as our cousins over the water say; and now that so many transformers are banked together in one place, the cost of an attendant is negligible, and he can be relied upon to keep the number of transformers in circuit fairly equal to the load. The attendance required is not much nor for a long time, and when once sub-stations are finished and fully connected up, an attendant can easily regulate his time and attendance upon several sub-stations.

No matter how we look at the automatic switching method, it does not reveal any advantages to recommend it, while it bristles with obvious difficulties, and even should an inventor by some miracle make it perfect in every detail, it would require to stand comparison only with the attendant; for the attendant is all that would be dispensed with in adopting the "compound intra-posed automatic system," or any of its kindred schemes. The question then resolves itself into whether the wages of attendants would exceed the cost, interest on capital, and maintenance of the "compound intra-posed automatic system."

This, however, is not the main point before us at present. What we require to know is, will the compound intra-posed automatic "system" in practice work at all? In the communication there is not a particle of evidence to show that it has been successful, and quite as little to lead us to expect that it would be so.

The tendency of all modern engineering is towards simplicity. Additional mechanism is very properly looked upon with disapproval, and if it must be adopted, it is generally considered a necessary evil to be eliminated by some means later on. And in engineering it is often better to suffer some small losses than to introduce complications by adding more mechanisms with a view to reduce them. In the case before us the loss has been reduced to a very small quantity by improving the transformers without adding anything to them, and by working from sub-stations with an attendant, the whole difficulty is entirely overcome, so that any "compound intra-posed automatic system" is at this day entirely superfluous, even granted that such a system could be made perfect, but there are so many apparent difficulties in automatic switching on a large scale, that only actual demonstration could be accepted as proof of its practicability.

Alternating Currents v. Continuous Currents as a Source of Electrical Heat in Chemical Industries.

In a recent Note we referred to some successful experiments by Bucherer in the application of electrical heat to the concentration of sulphuric acid. These experiments have evidently attracted considerable attention, and in many cases have been repeated. Some by C. Häusserman and F. Niethammer, however, have yielded very unsatisfactory results with continuous direct currents owing to electrolysis and consequent loss. Sulphur soon made its appearance, and sulphuretted hydrogen and other gases were evolved, the current partly passing through the acid by the shorter path. After two and a-half hours, 42 grammes weight was lost by the acid: whilst the strength had only risen to 61° B. In another experiment under modified conditions, a considerable separation of sulphur and evolution of gases occurred, the acid itself acting as a "second path" to a large extent and electrolysis consequently taking place. A considerable loss, therefore, was registered, whilst the concentration was but slightly improved. It was ultimately found impracticable to diminish the resistance of the wire to such an extent as to render the branch current passing through the acid negligible, because in that case the heat developed, proportionate to the square of the current, proved to be insufficient for the evaporation of the acid. And with larger current strength, the branch current, and consequently the electrolysis, was found to be increased. Better results in every way, were, however, obtained when alternating currents were employed. In a small test experiment imitating as closely as possible the conditions likely to exist in actual practice, 190 grammes of sulphuric acid, 60° B., were concentrated to 65·8 B. at 15° C., with a loss of 35 grammes in three and a-quarter hours, the temperature rising to 286°, and remaining nearly constant throughout the operation. No visible sulphur was deposited, although a slight disengagement of gas occurred along the length of the wire. The loss, however, prevents the experiment from being regarded as satisfactory. Bucherer showed that electricity could do better than that. In these experiments with alternating currents, the current employed was derived from a lighting supply of 110 volts and 0·9 ampères, and converted by suitable transformers into an alternating current of 6—7 volts and 14 ampères. The energy consumed during the production of 155 grammes of concentrated acid amounted to 296 watt hours, or about 1,490 per kilogramme. Those of our readers who are specially interested will find further details in the *Chemiker Zeitung*, xvii., pp. 1,907, 1,908.

THE INCANDESCENCE LAMP.*

By A. BAINVILLE.

(*Continued from page* 579.)

The Bulb.

We have little to say about the manufacture of the bulb; an operation generally confined to certain special factories. In fact there are not many makers of incandescence lamps who manufacture their own bulbs, both on account of the expenditure required for the necessary installation, and the number of experiments that have to be made before any good results can be obtained; moreover, the readiness with which they may be procured from the various glass works which have manufactured the bulbs since the lamp first came into use, has rendered it almost unnecessary for lamp manufacturers to undertake this branch of their trade. The glass works, however, would do well to lower their price for these bulbs, for this important branch of the glass trade, which as we know is likely to be permanent, may otherwise be taken out of the hands of the French manufacturers, who were the first to undertake the supply of these articles.

Some lamp manufacturers blow their own bulbs from glass tubes, but this does not seem a very economical course. The bulbs of incandescence lamps are generally made of crystal glass, but Bohemian glass has also been employed. Whatever kind is used, however, the glass must possess certain indispensable qualities; it must be very transparent, it must be capable of being easily fused to the platinum, and lastly, it must have a coefficient of linear expansion, to all intents equal to that of platinum.

These qualities are all found in crystal.

Platinum can be fused to crystal with the greatest facility; in the first place, it does not oxidise in the flame of the blow-pipe, and moreover the fusing gives rise to a chemical combination into which both the silicium and the lead of the crystal seem to enter. It would be easy to confirm this by analysis; but we observe that the platinum that has been fused to the crystal becomes brittle and melts at a lower temperature. This chemical action, be it understood, favours the fusing and renders it perfect. This phenomenon, which is attributable to the chemical properties of platinum, forms one of the reasons for the preference given to this metal and crystal.

It is not sufficient, as we have said, that the platinum should be well fused; the fusing must also be capable of resisting the variations of temperature to which the lamp is subjected whilst in use. This is why the coefficients of linear expansion of the two substances in contact should be the same. We can easily understand that if the expansions are different, we shall find even with slight variations of temperature that there will be an excessive tension over the whole surface of the fusing, and that this tension will, at a given moment, cause the crystal to break. Thus we often find lamps crack long after they are sent out. The composition of the crystal fulfilling these different requirements is now well known. We must make several experiments, *i.e.*, we must make up our minds to a certain sacrifice of material before a suitable composition is arrived at.

Several glass works now send out bulbs that are almost irreproachable.

The manufacture of the bulbs is exceedingly simple. Their shape is, in fact, the initial form of almost all pieces of blown glass. It requires skilful workmen, however, and, notwithstanding their skill, the regularity of the bulbs made in this manner by hand is never perfect. As these little differences of shape and dimensions are objectionable, the manufacturers prefer to use moulds by which means the dimensions of the bulbs are rendered strictly uniform.

The moulds employed are similar to those used in the manufacture of bottles; they are of iron, and open out into two halves. The workman introduces his blow-pipe into the mould with a sufficient quantity of material; he then blows, turning the cane between his hands, so as to obtain uniform thickness; the mould has then to be opened and the bulb withdrawn, it being separated from the pipe by the usual methods. This last method does not yield bulbs of such purity as the first. The moulded bulbs often show transverse marks and different thicknesses. However, with skilled workmen, good results are obtained, and in all cases these little imperfections are largely compensated by the great regularity of the bulbs thus obtained.

Well-made bulbs should be very regular as regards thickness. This point is of some importance both on account of the distribution of the light emitted by the lamp and on account of the absorption of the rays. From this last point of view, even, the bulbs should be as thin as possible. The thickness of the glass rarely exceeds six to seven-tenths of a millimetre; this thinness, however, must not be pushed to extremes, or the lamp might burst when the vacuum is being made, or even when it is quite completed.

Bulbs are also made in the same manner of crystal of various colours,† which can also be very readily fused to the platinum.

The shape of the bulbs is not a matter of great importance. Each manufacturer adopts a certain special shape which constitutes, to a certain extent, a trade mark. All these shapes, however, are so constituted that their greatest dimension corresponds to the point where the greatest quantity of heat is developed; *i.e.*, for the twisted filaments, for instance, the bulbs are blown out in the middle. The cylindrical shapes, and, generally speaking, all the special forms given to fancy lamps, are not so well adapted to the purposes for which they are made, and thus these lamps are placed in unfavourable conditions, and so are less durable.

The dimensions of the bulbs, likewise, should not be left to chance. Although there are as yet no established rules for determining what are the most suitable dimensions for a given type of lamp, they should be, as far as possible, in proportion to the energy expended in the lamp. This, however, is not an absolute rule, seeing that as regards blackening, we need only take into account the surface of the filament, and as regards the vacuum, it is to our interest to reduce the dimensions of the bulb as far as possible. The more the lamps are blown out, *i.e.*, the lower their wattage is, the greater must their dimensions be for the same surface of filament. These practical rules have resulted in dimensions varying considerably with different makers of a given type of lamp; thus they are far from being absolute, as we have already said.

The Support of the Filament.

By the support we mean the two metallic wires fixed to the extremities of the filament, and connecting it with the circuit.

These two wires, which constitute the terminals of the lamp, are generally of platinum. This metal is chosen for several reasons. Many attempts have been made to substitute some other substance for platinum, the price of which is, as we know, very high, and has fluctuated considerably lately. Up to the present, however, none of these attempts have, to our knowledge, met with any success. It is necessary, in fact, as we have already said, that these metallic wires, which are to pass through the crystal, should be fused perfectly to it, *i.e.*, that the joint should be absolutely air-tight. Now, common metals become very rapidly oxidised at a high temperature, especially in the flame that has to be employed for working the crystal. Platinum has not this drawback; moreover, its coefficient of expansion is sufficiently near to that of glass for a suitable composition to be easily found. We might perhaps find certain enamels which would seal up any metal whatever; but we could not depend upon such joints being thoroughly air-tight, and besides, the employment of these enamels would probably be very inconvenient, both on account of the number of hands that would have to be employed, and the price of the enamel itself.

As really platinum is only necessary at the part where the wires pass into the bulb, the length used, and consequently the expense entailed by its use, may be considerably reduced by limiting it to this part only. The support then consists of two metals soldered end to end. Copper and nickel are most employed for this purpose. The two metallic wires constituting the support must be fashioned so as to receive the filament.

The most common mode of doing this is to form a tube at the extremity, to be connected to the filament, and this is the method we will describe. The metal wire is first cut

* *L'Electricien.*

into suitable lengths. The tube may be obtained in various ways.

If platinum is used for the whole length, one of the ends is flattened out for some millimetres, and this flattened part is then passed through a drawing frame. A little tube is thus obtained, in which the end of the filament can easily be placed. The same implement can, in this case, cut and flatten out the wire.

If, on the other hand, the support is made in two parts, we need no longer think of economising the material, and the extremity can then be made into a spiral, so as to form a little hollow cylinder.

In some lamp works the tube is dispensed with, and the wire is merely slightly flattened at one end; but this requires a special material.

When the wires are thus prepared, they are ready to receive the filaments. But some manufacturers prefer to connect them two and two together by a little ring of glass, which keeps them at the required distance from one another. For this purpose two lengths of the prepared wire are placed in a special holder, and with the aid of a little blow-pipe, a little bar of crystal is melted upon them. This work, which is quickly done, and costs little, is of little use if the filaments are very fragile; and for this reason we find that very short filaments are still used, as they have less elasticity.

We will now proceed to describe the process of mounting the filament on its support. In the first lamps, the methods used were purely mechanical, *i.e.*, the filament was merely secured firmly to its support by any method whatever. These modes have, however, been abandoned, and we will now only describe those in use at the present day.

The Mounting of the Filament.

This operation consists in placing the filament in the support we have just described; it is therefore very simple when this support is in the form of a tube. The workwoman to whom this work is entrusted inserts the filament into the two tubes of the support and fixes it at the length required for the lamp by slightly pressing the tubes. But this operation is preceded by another, viz., the sorting of the filaments.

We have seen that before being placed in the crucibles the filaments were separated according to their diameters before calcination. If, then, the filaments were perfectly regular in their section, and the conditions under which the carbonisation was effected were exactly similar for each filament, it is evident that the filaments that were of the same diameter before being put into the crucibles would be contracted in the same manner, and would all present the same section on being taken out of the furnace. We should then have only to measure one filament in each lot in order to determine the diameters after calcination. But this cannot be done in practice, as it is impossible to keep the conditions exactly the same for each filament. Thus the greater number of filaments, if not the whole batch, have to be measured before they can be inserted into the supports.

This sorting is a very delicate operation, since the filaments to be measured are very fragile, and often of very small diameter, and the measurement has to be as correct as possible.

The instruments used at present for this work are far from satisfactory. The microscope method, which is certainly the most accurate, is too delicate and too slow for industrial use. We are, therefore, obliged to have recourse to micrometers and gauges that have not been constructed for this purpose; calipers cannot be employed, as a rule, on account of the fragility of the filament. Several small dial micrometers have been constructed in which the pressure of the jaws is very slight, but they soon get unreliable. It would be worth while for makers of these instruments to endeavour to bring out a special model which should be at once strong, easy to use, and reliable.

The Fusing of the Filament.

We have shown how the filament is clasped in its support at the required length by the workwoman to whom this operation is entrusted. It must now be fixed firmly in this position, for the filament must not be able to slip in its support, and, moreover, the joint must not offer any resistance to the passage of the current.

The quantity of energy absorbed both by the support and the fusing must be regarded as wasted, as in neither case is it transformed into light. This expenditure of energy must, therefore, be reduced to a minimum. Now, if we consider not so much the saving of electrical energy as the durability of the lamp, which is a point that most consumers find still more essential, we see that the same conditions must be observed. If the fusing is not complete, the filament will gradually become detached from the support, and the lamp will soon become useless, especially if it is subjected to any vibration; or, again, becoming red hot, the metal wire in contact will be melted; or, lastly, if the slight fusing forms only an imperfect connection between the filament and its support, a little arc may be produced which will even more surely destroy the lamp. We often observe, and especially in lamps of high voltage, a curious phenomenon which also tends to lessen the durability of a lamp, and which seems due to imperfect fusion. This is a bluish halo which sometimes envelops the jointing like a sheath, and is sometimes produced at one particular point; this phenomenon often lasts only a little while, and disappears in the course of the operations, but sometimes it so heats the metal of the support that it melts. This particular phenomenon seems analogous to the marks observed in a vacuum tube subjected to a discharge. It is generally manifested at the positive pole, although sometimes it is observed at the two fusings at the same time. These appearances are probably due to gaseous emanations produced at the jointings, and which modify the pressure on the inside of the bulb.

These few details show us the importance of the fusing of the filament to its support, and the care that is required in this operation.

At the present day the fusing is performed in the same manner at all the lamp works. A deposit of carbon is used in place of the electrolytic deposit of copper which Edison used for connecting the filament to its support.

At some lamp works, a liquid paste, with a basis of carbon, is laid on with a brush at the junction of the wire and the filament. This is allowed to dry, and by sending a current only into the part where this deposit has been laid on, it is hardened sufficiently to adhere closely; sometimes this drying current is the one which passes through the whole filament at the time when the vacuum is formed. This method, however, is not much used.

As a rule the deposit of carbon is obtained by the decomposition of a liquid or gaseous hydro-carbon. This method is very simple, and results in the production of a very dense carbon; the adherence of this, both to the filament and the support is much greater than with the other method. On the other hand, the conductivity of this special carbon is far above that of the carbon obtained by means of the paste; thus the jointing may be pretty small, and at the same time offer a very slight electrical resistance.

In the operation special pincers are employed, which enable the passage of the current to be limited to the place where the deposit has to be formed. For this purpose the two wires of the support are held at their free extremities by two spring contacts insulated from one another. A rod of metal perpendicular to the direction of the support is placed at a distance of some millimetres from the other extremity of the wires, and thus forms a bridge connecting the two branches of the filament.

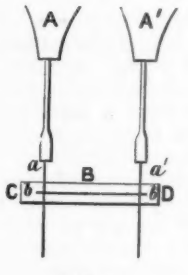


Fig. 3.

The accompanying diagram shows the principle of the special pincers (fig. 3).

A, A', are the contacts in which are placed the extremities

of the support, B is the bar connecting the two branches of the filament. The current follows the direction, A, B, A′, and the derivation in the filament is almost *nil*. The bar, B, presses the filament against a fixed part C, D; this pressure must be extremely slight, but at the same time ensure a good contact, for otherwise the total current would pass through the filament and in certain cases might deteriorate it. The distances which separate the extremities of the support, *a* and *a′*, from the bar, B, must be equal; it is along this length that the deposit is to adhere, and also to the metal wire in its immediate vicinity.

When the current is sent into the pincers, if it is of sufficient intensity, we shall find that the parts, *a b*, *a′ b′*, will become luminous. This effect is due, as we can easily understand, to the difference in conductivity of the successive portions of the circuit, A B A′; the portions, *a b*, *a′ b′*, in fact belong to the filament, the resistance of which per unit of length is far above that of the metallic support, and moreover, at the point of junction of the latter with the filament, the contact is imperfect. The very high temperature which is produced at these two points decomposes the liquid or gaseous hydro-carbon in which the whole is plunged, and the molecules of carbon are deposited at the point where this decomposition is produced.

The electrical resistance of the conducting system, A B A′, is constantly decreasing during the operation; we must, therefore, in order to maintain a temperature favourable to the decomposition, gradually increase the difference of potential at the points A and A′. This increase must be all the greater, as the loss by conductivity of the incandescent portion increases as the deposit is formed, since at the same time the surface becomes greater.

The intensity of current required to effect the fusions will therefore be much higher than that which will pass through them when the lamp is finished. In liquids it amounts to 10 or 12 ampères for filaments requiring 6 ampères when in service. As this difference is due solely to the loss through conductivity, it varies in different cases, and is less in gases than in liquids. The employment of liquids for the jointing requires a certain amount of caution. The abundant fumes which are given off during the formation of the deposit are inflammable, and the apparatus must be constructed in such a manner that the current cannot pass through them, whilst the parts that are to be rendered incandescent are not completely immersed in the liquid.

(*To be continued.*)

REAR-ADMIRAL FLEURIAIS'S ELECTRIC LOG.

M. FLEURIAIS'S log, tried in 1878 on board the *Magicienne*, was fitted with four hemispherical cups, like Robinson's anemometer, of which it was an adaptation. A circuit-closer mounted on the axle sent the current from a battery at first into a telephone and afterwards into a bell; the crackling of the membrane or the strokes on the bell showed the number of turns in a given time, and a converting table prepared beforehand gave the speed of the vessel. But when this speed increased, starting from about 12 knots, the strokes of the bell produced at each revolution of the vanes were so accelerated that it became difficult to count the exact number, and thus errors arose which were too great for approximate calculations.

M. Fleuriais, therefore, modified his former model, and the new log tried on board the *Ocean*, the *Duguay-Trouin*, the *Cécille*, and lastly, the *Wattignies*, has been adopted by the French navy after these trials. The apparatus measures ·247 metres in diameter and consists of two similar sets of four cups, A, A′ (fig. 1); the cups being thus eight in number, the rotating couple has such an energy that the slight variations in the passive resistances remain absolutely without influence. The axle has in the middle a deep screw; this screw engages in the teeth of a wheel, the surface of which is covered with an ivory disc which has three metal contacts; on this disc a spring, *r*, presses which is fixed to the conductor, C, formed of seven fine wires. This spring is coated with Chatterton's compound, except its extreme end which, being fitted with a silver button, remains bare so as to establish good contact between the wheel and the electric conductor.

The whole is enclosed in a bronze case with a cover which allows free passage to the water but keeps out rubbish, weeds, &c.

The bearings of the axle are of ash and also the jaws which hold the conductor firmly in the tube in which it is enclosed.

The log terminates in two bent wings, H, H, which ensure the immersion of the apparatus towards the bottom; the action is that of the Japanese kite reversed. This last

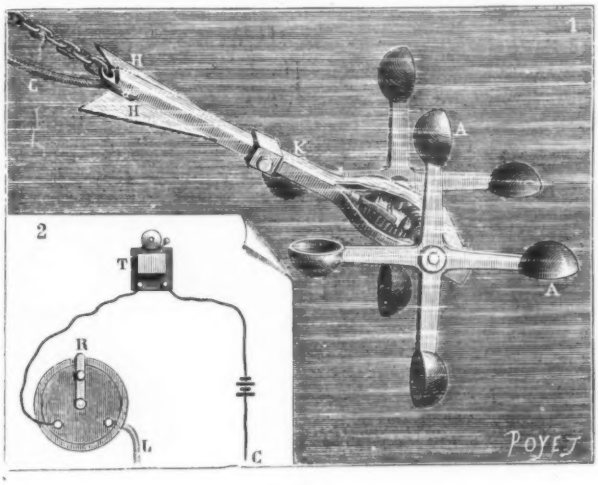


FIG. 1.

idea was suggested by M. de Maupeon, director of naval construction.

The towing line consisted at first of a cable of four strands, one of which was removed and replaced by the conductor; but as there was always a chance of the wire becoming twisted notwithstanding the fastenings of sail-twine which were made at each metre, M. Fleuriais adopts in preference a metal towing-line, which, at the same time, reduces the friction of the water, and consequently the traction, as much as possible. On board there is always a commutator acting in two directions (fig. 2), one of which is the position of rest, R, a bell, T, and two Leclanché elements, the positive pole of which communicates with the keel, at C.

When the log is submerged the vanes revolve and the screw works the toothed wheel. Every time the spring passes over one of the metal contacts, the circuit is closed and the bell sounds; but as this wheel has 72 teeth and three contacts, the bell only sounds once for 24 revolutions of the vanes. The intervals between two successive signals, 11 seconds for 8 knots, 8·8 seconds for 10 knots, 4·4 seconds for 20 knots, will thus be sufficiently great to prevent mistakes, and will enable the speed to be calculated with the greatest accuracy. In order to reckon seconds and fractions of a second M. Fleuriais has abandoned the sand-glass for a pendulum indicator which beats at intervals of $\frac{2}{10}$ths of a second, and which is started at the moment an observation is being taken. Assuming that we make a mistake of half-a-second, if we take a period of 50 seconds, the error will only be ·1 of a knot in the speed of a vessel. But the observation may be prolonged, and thus the error may be reduced indefinitely.

Unlike other systems, the circuit closer of the Fleuriais log is not enclosed in a water-tight box.* In this case, as soon as the commutator is submerged, it being closed, the battery works, since the current passes through the sea, the log and the conductor; nevertheless, the loss by the sea is not considerable, and the current has not then sufficient energy to ring the bell, which only rings at the moment the spring touches one of the contacts.

* The Granville electric log manufactured by Messrs. Elliott Bros., and fully described in the No. of the REVIEW for January 30th, 1891, has the contacts unenclosed.—EDS. ELEC. REV.

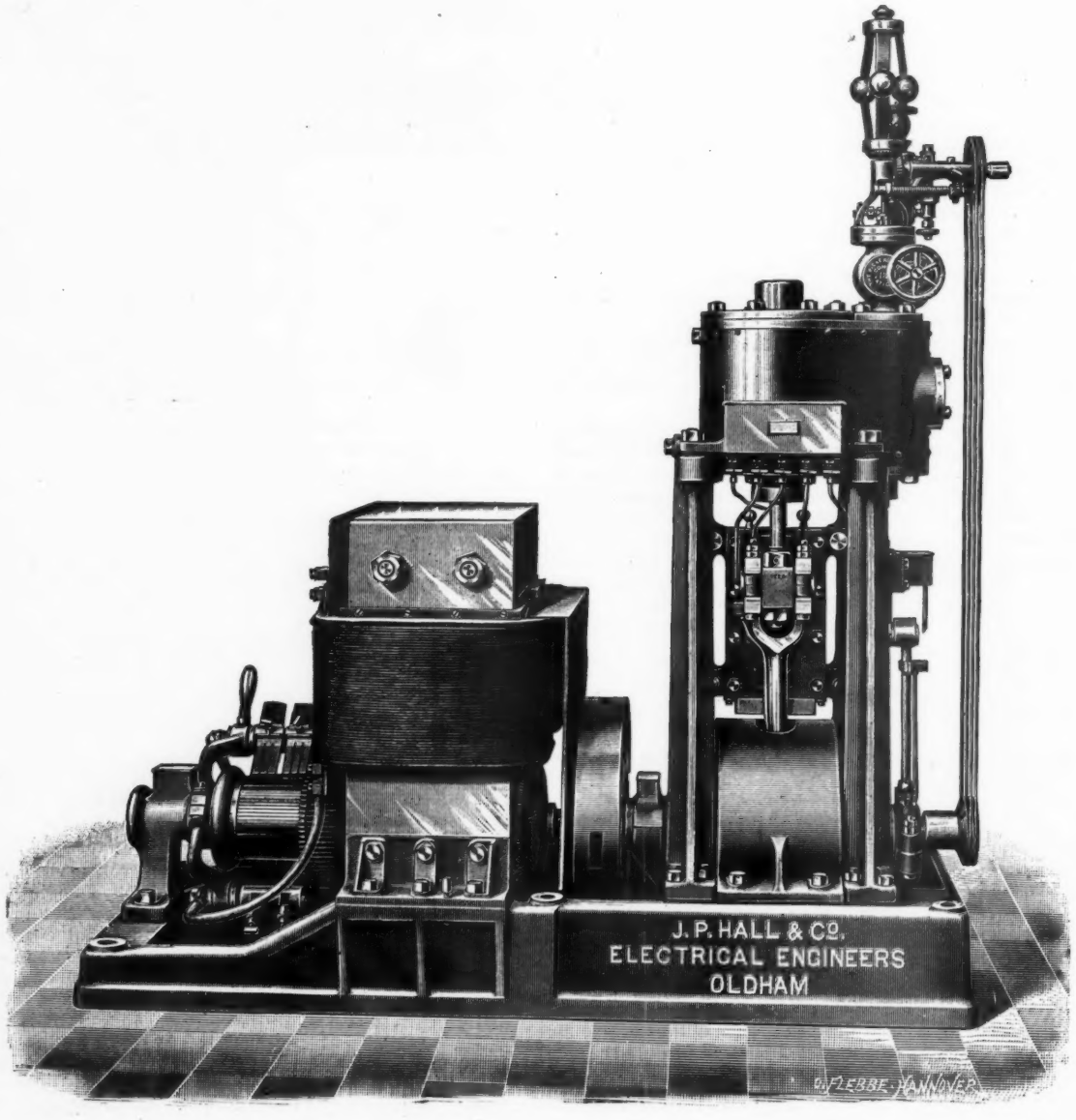
But with this arrangement M. Fleuriais had to devote all his attention to the perfect insulation of the single conductor, a precaution indispensable to the good working of the apparatus, but one which was not so essential with a water-tight box and an entirely metallic circuit, as in the Coffinières system, and the logs invented by Faymonville, Lopez de Hare, &c. Moreover, as registering logs are intended to be for the most part, if not always, under water, we must say that a water-tight case has the advantage of preserving the wheels from deterioration, either by the water or by the introduction of foreign bodies, however small they may be. The recent experiments made at Cherbourg by the *Davoust* showed that after 18 knots the log rises too near the surface, notwithstanding the curved wings. Sometimes the cups emerge from the water, and, consequently, the speed of rotation varies.

Nevertheless, in its present form, and whilst awaiting the test of long and frequent use, which might suggest fresh improvements to the learned admiral, the log, with double vanes, gives such close approximations to the truth that it will render useless and do away with trial trips on measured bases, known distances that serve in experiments to determine the speed of ships.

This arrangement, which answers excellently at the islands of Hyères, is, as M. Fleuriais observes, far from satisfactory, both from a theoretical and practical point of view, in other localities.—GEORGES DARY. (*La Nature.*)

COMBINED ENGINE AND DYNAMO.

THE illustration shows a combined single-cylinder high-pressure engine and compound wound dynamo, as manufactured by Messrs. J. P. Hall & Co., of Oldham. An engine of 28 I.H.P. runs at 400 revolutions per minute, it has a cylinder of 8½ inches diameter × 6½ inches stroke, lagged with planished sheet steel over non-conducting felt. The fly-wheel is of cast-iron and is made with special shaped slots for barring, which are so arranged that if the engine moves suddenly forward when the bar is in, it comes out automatically without risk or shock to the attendant. The governor is of the high-speed sensitive type, driven with ropes. The stroke of the valve may be controlled by a sensitive fly-wheel governor, carrying the eccentric and automatically regulating the speed by varying the cut-off to suit the load, the speed remaining constant. The bearings are of large area and fitted with phosphor-bronze bushes lined with magnolia metal, and have continuous lubrication. All the working parts, except the crank bearings, are lubricated from a main oil box by brass tubes fitted with syphons and taps by which the flow of oil may be regulated. The dynamo running with this engine gives 150 ampères at 100 volts, at 400 revolutions per minute. It has Gramme armatures, series coils of low resistance and accurately



adjusted, so that the E.M.F. is self-regulating at a constant speed to within two per cent. of the normal with varying loads. The insulation between the series and shunt coils is of incombustible material. The insulation of the armature is mica and tape throughout, and coated with varnish. The commutator is of large diameter, with 80 bars of hard drawn copper insulated entirely with mica. The depth of the bars in the direction of wear is 1¼ inches. The collecting gear consists of four brushes, two + and two —. The whole of the parts are so arranged and proportioned that the increase in temperature above that of the surrounding air will not exceed a safe limit after a 10 hours' continuation run with full load.

THE KINETO-PHONOGRAPH.*

Thomas A. Edison conceived the idea of the simultaneous record and reproduction of sound and motion in 1887, the idea naturally being suggested by that familiar toy, the zoetrope. The work of the inventor and his assistants has borne fruit in the kinetograph and the kinetoscope, which are now making claims upon public attention, and which, whatever may prove to be their practical value, will stand as striking illustrations of human ingenuity and patience. That Mr. Edison himself believes in the future possibilities of this device is evidenced by the following recently published statement: "I believe that in coming years, by my own work and that of Dickson, Muybridge, Marie and others who will doubtless enter the field, that grand opera can be given at the Metropolitan Opera House at New York without any material change from the original, and with artists and musicians long since dead."

The principle of the kinetograph—the recording—and the kinetoscope—the reproducing—instrument is doubtless generally understood. A series of photographs of the object or objects which it is desired to reproduce are taken with a rapidity of between 40 and 50 views per second. These photographs are then developed and by means of the kinetoscope are either projected upon a screen or exposed directly to the eye at the same rate of motion. As the interval between the exposure of the successive photographs is too short to be appreciated by the human eye, the motions of the subject appear continuous to the observer. It is apparent that this invention lies largely in the realm of photography and, as in the phonograph, electricity plays a subsidiary part.

The kinetograph reaches its highest sphere of usefulness in conjunction with the phonograph, by which it is intended to reproduce every word and movement of the subject in their proper relation. For the combined instrument, the name "kineto-phonograph" has appropriately been suggested. While the kineto-phonograph has not been brought to a sufficiently practical form for public exhibition, as has the kinetoscope, the experiments in the inventor's laboratory have been so successful that it is regarded only as a question of time, by those engaged in the work, when the apparatus will be perfected.

The credit for the development of the kinetograph and kinetoscope belongs, after the inventor himself, to Mr. W. K. L. Dickson, whose wide experience in photography and familiarity with the application of electricity have rendered him an invaluable assistant to Mr. Edison. In the June number of the *Century*, Antonia and W. K. L. Dickson trace the history and development of the invention and point out some of the many difficulties which beset the path of the experimenter along these lines.

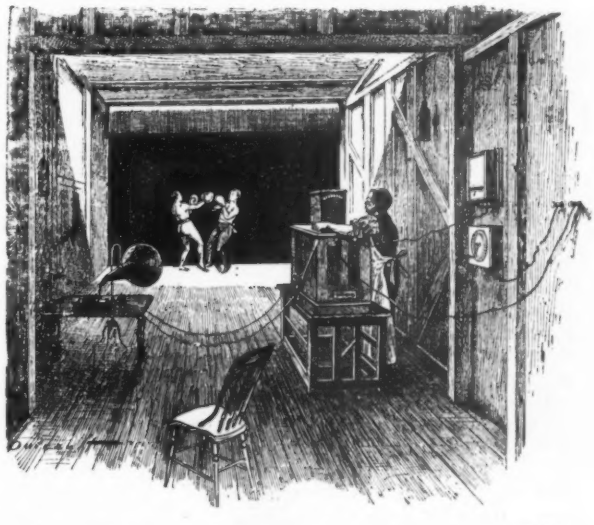
The first experiments were made with a cylindrical shell, the same size as the ordinary phonograph cylinder, upon which minute photographs were placed. The two cylinders were placed on a shaft side by side, and the photographic and phonographic impressions taken as nearly at the same time as possible. Photography at such a high rate of speed was a new art and the first results were not especially promising. The Daguerre, albumen and other similar known processes failed, and an attempt was made to use cylinders coated with the Maddox gelatine bromide of silver emulsion, but the difficulty here was that when the minute photographs were enlarged they were unduly coarse.

The next move was to try larger impressions, which were swiftly rotated upon the edge of a wheel or disc, supplied with a number of pins, which projected under the centre of each picture. These pins successively broke the primary circuit of an induction coil, to the secondary of which was connected a Geissler tube. The tube was lighted at the exact moment the picture passed before it. The results were very encouraging. Experiments were then made with celluloid films placed on drums something like the old tinfoil phonograph. The pictures were taken spirally, the sheet of celluloid removed and developed and then placed on a hollow drum, inside of which was a Geissler tube connected to an induction coil. Brass pins on the exterior of the cylinder broke the circuit at the proper moment and each picture was in turn illuminated. A highly sensitised strip of celluloid half an inch wide, was then tried, but the width was soon increased to an inch and a half. The photographs were but an inch in width, but the extra width was perforated and a locking device employed to hold the film steady during the infinitesimal time—about the one-fiftieth part of a second—during which the shutter opened and a photograph was taken. Then in about 1-460th part of a second the film is jerked forward and again held at rest and another photograph taken. This system allows an exposure of one-hundredth part of a second for each picture, which is sufficient for excellent work.

The speed of this photographic work is certainly astonishing. Forty-six impressions are taken each second, which is 2,760 a minute and 165,600 an hour; or, as Mr. Dickson has graphically put it, "were the spasmodic motions added up by themselves, exclusive of arrest, on the same principle that a train record is computed independent of stoppages, the incredible speed of twenty-six miles an hour would be shown."

After securing the negative, the next step is to secure a positive strip of film. When this is prepared it is ready to be placed in the kinetoscope or photo-kinetoscope. When a phonographic record has been taken simultaneously with such a strip, the two are started together by a simple device and kept together throughout the reproduction, a single electric motor operating both. One of the greatest difficulties met with by the experimenters was the nicety of adjustment required to simultaneously record and reproduce the sound and motion.

In taking the photographs, either sunlight or artificial light is employed; in the latter case four parabolic magnesium lamps or twenty arc lamps, provided with highly actinic carbons, supplied with powerful reflectors, are used. A special building has been constructed for photographic purposes, an interior view of which is herewith given. It swings on a central pivot, so as to obtain any desired light. A stage is arranged inside and provision made for very sharp contrasts of light and shade.



The only form of this apparatus yet placed on public exhibition is a nickel-in-the-slot form of the kinetoscope. Several of these machines may be seen in one of the accom-

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* *Electrical World*, New York.

panying views, which shows the interior of an exhibition room on Broadway, New York City. They consist of a cabinet containing an electric motor and accumulator cells for operating the mechanism which moves the film. The film is in the form of an endless band, 50 feet in length, which is passed through the field of a perpendicular magnifying glass. The impressions pass before the eye at the rate of 46 per second by means of a rotating slotted disc, the slot of which exposes a picture at each revolution and separates the fractional gradations of pose.

As to the future of this most ingenious and interesting bit of mechanism, time only will demonstrate whether it is to be a mere scientific toy or an invention of real practical value.

THE LEWIS ARC LAMP.

The arc lamp is still the subject of improvements at the hands of many inventors, although but few notable inventions are to be found among the many so-called new arc lamps continually brought to our notice. In this new lamp we believe quite a novel mechanism has been applied to operate the feeding of the carbon and the striking of the arc. In it there are two mechanisms combined, one to strike the arc, the other to effect the feeding. Both are controlled by one electro-magnetic appliance, which is preferably a solenoid with a freely floating core, and the beauty of the combination consists in the absolute independence of the striking gear from the feeding gear, despite the fact that both are combined in one and governed by one electro-magnetic device.

The mechanism consists of three mitre wheels as shown in figs. 1, 2, and 3. Fig. 1 shows the striking side of the

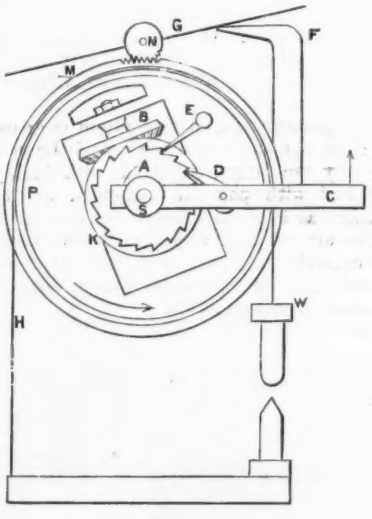

Fig. 1.

mechanism in diagram; C is the lever which is worked up or down by the core of the solenoid; *d*, is a pawl engaging into the ratchet wheel, *a*; *e* is a fixed pawl attached to the framework which keeps A from running back; A is fixed on the back of one of the mitre wheels, K. The lever, C, and the ratchet and mitre wheels are all loose on spindle S, which is not movable. It will be evident, if we work the lever up, the ratchet and mitre wheel will be moved round. The mitre wheel, K, gears into another mitre wheel, B, which is loose on a stud fixed in the pulley, P, over which the carbons are hung, and this mitre wheel, B, gears into another mitre wheel on the other side which is fixed to a large toothed wheel, M, as shown at O in fig. 2, which illustrates the feeding side of the mechanism. These wheels also revolve loose. On the spindle, S, into the large toothed wheel is geared a pinion, N, carrying a fly, G, which, upon the rise of the lever C, locks, by means of the detent F, the wheels, M and O, at an early point in the upward movement of the lever. Now, if one of the mitre wheels is locked in this way and the lever continues to rise, pulley P will be rotated on the spindle, S, on which it is loose, mitre B rolling

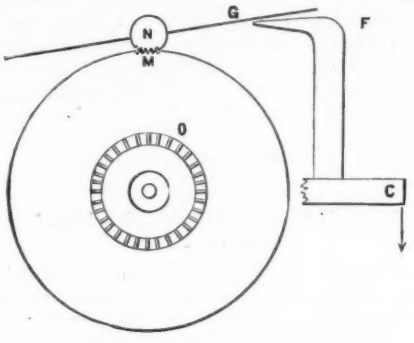

Fig. 2.

on the fixed mitre O, and being driven by K. This rotation of P evidently parts the carbons and forms the arc, and thus the arc strikes. Now for the feeding: The fixed pawl will keep the ratchet, A, from running back when the lever, C, descends as the arc burns open and the solenoid allows the core to fall, but at a certain point in the fall of lever C, detent F lets the fly go, releasing the mitre and wheels on the feeding side, so that pulley P can move back. A and K being locked

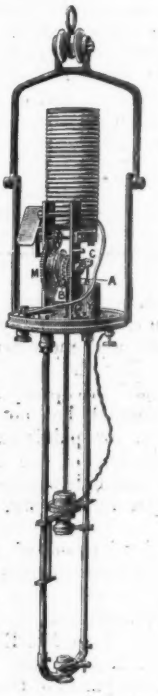

Fig. 3.

by E, mitre B rolls now on K, being pulled round by the preponderating weight of the upper carbon holder, W; but immediately the arc closes the least bit, lever C is pulled up and stops the fly, thus locking pulley, P, again. This action of the lever and fly is so quick that only half a turn of the fly is allowed at a feed.

It is obvious that between the feeds the whole mechanism is absolutely locked; A is locked by pawl E, and O is locked by the detent and fly, so that no vibration can affect the steadiness of the arc.

In these figures the lamp is shown as a focussing lamp, but in fig. 3 a complete lamp of the coiled band type is shown. The large toothed wheel, M, can be seen gearing into the pinion, and two of the mitre wheels, B and A, can be seen on the striking side. The lever, C, is made double and weighted to balance, and a dash-pot is attached to it as shown at Y. This dash-pot is a dry one, and acts only at the moment of striking the arc, as it is worked by a pin in the lever, C, in a slot, so that when the lever descends to near the feeding point the piston rests on the bottom of the pot, and the lever works free, as the pin moves in the slot on its further downward course.

This is an extremely neat arrangement and acts to perfection; and it is not likely to miss feeding or get out of order.

The lamp shown is a single coil lamp for running in simple parallel on a 50 volt alternating circuit. It will be clear that any kind of lamp can be made with this gearing merely by substituting other electro-magnetic devices for the single coil.

We may add that Mr. Lewis was recently a student at Faraday House, and his invention reflects considerable credit upon that institution as an electrical engineering training school.

THE THREE-WIRE SYSTEM IN TRACTION WORK.

A short time ago we referred to this system in reviewing the different proposals made towards getting rid of or mitigating the electrolytic troubles met with in electric traction in systems using an earth return. A three-wire system promises not only to cure that evil, but also, to some extent, to remove the troubles affecting telephone and telegraph systems arising from the large earth currents flowing from electric traction railways. It further saves about 50 per cent. of copper over a complete metallic circuit system, and requires the use of only one trolley. It is true that the earth is used as the third conductor, but the current has a short path in the earth circuit, so that it is confined to the distance between the cars instead of to the distance between the cars and the power-house, as will be readily seen in fig. 1.

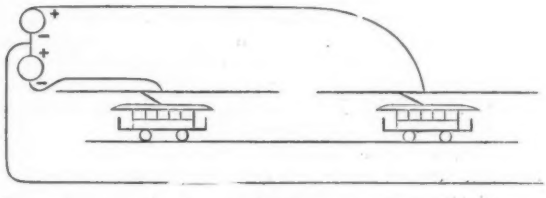

Fig. 1.

Fig. 2 shows the connections of the feeders and the sections of the trolley wire; from these figures the nature of the system may be gathered. The sections are of considerable length, with a quick service the cars follow at regular intervals, and are fairly evenly distributed over the system. Bunching of the cars on one section would, of course, disturb the balance and produce a temporary flow of current of large volume through earth. But that cannot often happen to such an extent as to cause more than a fraction of the total current to flow by earth return.

In the case where the power house is at a distance from the railway system, as, for instance, where water-power may be utilised, the three wires, 1, 2, 3, in fig. 2, are brought up to the centre of the service wire system, and from that point the feeders spring from wires 1 and 2, and at that point the neutral wire, 3, is grounded to the rails, which are banded at the joints.

The system has been in daily use at Portland, Oregon, during the past two years without a hitch, and no electrolytic troubles have arisen, while in other places, using the ordinary systems during the same time, destruction of water, gas, and other pipes is going on rapidly.

The system is also used at Bangor, Maine, and has been running there for some time.

The street railway systems of Portland, Oregon, receive the greater part of their power from the Union Power Company. In order to obtain cheap fuel, the station of the Union Power Company was placed near a large saw mill, and the refuse from this mill used. The distance between the station

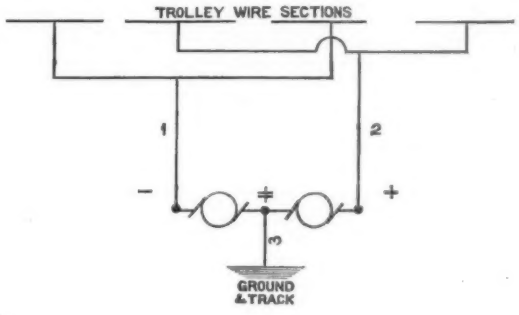

Fig. 2.

and the centres of the systems supplied with power is about three miles, and at times the load upon the station approximates 1,500 horse-power. Early in the course of estimating the probable cost of installing the electric systems, it became apparent that if the station were to be placed near the saw mill, to take advantage of the cheap fuel, the extra cost on the ordinary systems for feeders would be considerable. To reduce this cost, it was decided to adopt the three-wire system of distribution. This had been shown to be a success in lighting work, but had not been previously tried in the actual every-day operation of street railways. A direct illustration of one of its advantages was had as follows:—Part of the system supplied with power was in readiness and in use some months before the whole system was completed. This section had eleven double reduction Sprague motor equipments in operation, and the feeders supplying the power were arranged on the ordinary plan for railway operation, but were calculated to run 17 cars after the whole system should be completed. As the feeders were calculated on the three-wire basis, it was found necessary to run the generators at 600 volts, and even then, at times, the voltage on the line fell to 350 volts. When the whole system was put in operation, no change was made in the number or arrangement of the feeders for this section, the six cars were added, the voltage at the generators was lowered to 550, and yet the voltage at the cars never fell below 450 volts.

The wiring of the car, the overhead construction, the track, in short, all the installation outside of the power house, is done according to ordinary two-wire usage. Each feeder, or set of feeders, supplies a section. This section is insulated from the adjoining sections. Alternate sections are of opposite polarity, and there is a difference of potential of 1,100 volts between the sections of trolley wire. The station installation is according to ordinary three-wire lighting usage, except that no compensating or potential regulating devices are used on the feeders.

The operation of the dynamos does not differ from the operation of the same machines in ordinary railway usage.

It will be obvious that if in a double track railway the + sections are parallel with the − sections, or if, as in Philadelphia, single tracks are run in parallel streets and the + and − sections are parallel, the return circuit between the sections must be, in general, very short circuits. The engineer, by the exercise of judgment, can easily plan the length and disposition of each section, so that the earth circuits may be as short as possible in any case, and provide for a fairly even balance of the load.

The high pressure between the sections is the only excep-

tion we take to the system. To what extent the system may eliminate the telegraph and telephone troubles we cannot estimate; practice alone can decide that question, and the reports on the system do not refer to the point.

THE MIRROR GALVANOMETER.

It is generally supposed, and indeed we believe has been stated by Lord Kelvin, that it is a matter of indifference in what position the Mirror galvanometer is set up; that by means of the adjusting magnet the needle can always be brought to zero, and at the same time be made to have the same figure of merit in all cases. Some recent experiments by Mr. A. E. Perkins, the Gutta-Percha Company's electrician at the Wharf Road Works, seems to indicate that the supposition is not wholly true, and that there are positions in which, if the galvanometer is set up, the adjusting magnet cannot bring the needle to zero without reducing its sensitiveness. The test method adopted by Mr. Perkins was to set the instruments at various angles in the magnetic meridian, and then by means of the adjusting magnet to bring the needle to zero, and also to adjust the magnet so as, if possible, to produce the same figure of merit in all cases. Discharge deflections were also taken in each case, and also the rates of oscillation of the needle. The following table shows the results actually obtained :—

Experiments with Galvanometer No. 706 in various Positions, June 6th, 1894.

Position of galvanometer.	300 volts constant through one megohm.	Ten cells discharge from one microfarad.	Number of oscillations.	Height of magnet from top of case.	Remarks.
				Inches.	
Needle, N. and S. Mirror face, W.	100,000	2,700	5 in 20 sec.	$2\frac{3}{4}$	N. of controlling magnet pointing 10° W., and to right of galvanometer.
Mirror face, S.W., 45°	100,000	2,710	5 in 20 sec.	3	N. of controlling magnet pointing 26° W., nearly 45° more to front of galvanometer.
Mirror face, S., 90°	100,000	2,700	5 in 21 sec.	$3\frac{1}{2}$	N. of controlling magnet pointing 60° W., rather more same way.
Mirror face, S.E., 135°	100,000*	2,600	5 in 20 sec.	$6\frac{1}{2}$	N. of controlling magnet exactly behind galvanometer, pointing 45° N.W. Could not get spot on scale.
Mirror face, E., 180°	100,000	2,700	5 in 19 sec.	$6\frac{3}{16}$	N. of controlling magnet pointing towards the north, and to left of galvanometer.
Mirror face, N.E., 225°	100,000*	2,800	5 in 19 sec.	$5\frac{7}{8}$	N. of controlling magnet exactly in front of galvanometer. Could not get spot on scale.
Mirror face, N., 270°	100,000	2,700	5 in 20 sec.	$3\frac{3}{4}$	N. of controlling magnet points to N.N.E., 25° E.
Mirror face, N.W., 315°	100,000	2,690	5 in 20 sec.	3	N. of controlling magnet pointing nearly north.
Mirror face, W., 360°	100,000	2,700	5 in 20 sec.	$2\frac{3}{4}$	N. of controlling magnet pointing 10° W., and to right of galvanometer.

* In these two positions the galvanometer is unstable.

It will be noticed that in two positions the instrument was unstable, that is to say, it was found to be impossible to bring and keep the spot of light to the zero position on the scale without considerably reducing its figure of merit; in order to obtain the figure of merit the same as in the other cases, the working zero had to be several inches off the end of the scale. In all other cases it will be noted that the figure of merit and rate of oscillation could be made substantially the same.

It would be interesting to know whether other experimenters have observed similar results.

The following table is of interest, as showing the diminution in sensitiveness of the instrument when the position of the instrument and the angular position of the adjusting magnet alone were altered, the *height* of the magnet on its stalk remaining constant.

Experiments with Galvanometer No. 706, in Various Positions, June 1st, 1894.

Position of galvanometer.	300 volts constant through 1 megohm.	10 cells discharge from 1 microfarad.	No. of oscillations.	Remarks.
Needle N. and S. Mirror face, W.	100,000	2,700	5 in 20 sec.	
Mirror face, S.W., 45°	90,000	2,600	5·5 in 20 sec.	
Mirror face, S., 90°	60,000	2,240	7 in 20 sec.	
Mirror face, S.E., 135°	38,000	1,850	8 in 20 sec.	
Mirror face, E., 180°	30,000	1,700	9 in 20 sec.	
Mirror face, N.E., 225°	36,000	1,810	8 in 20 sec.	
Mirror face, N., 270°	57,000	2,180	7 in 20 sec.	
Mirror face, N.W., 315°	87,000	2,580	5·5 in 20 sec.	
Mirror face, W., 360°	101,000	2,700	5 in 20 sec.	

THE GOVERNMENT AND THE TELEPHONES.

Several members of Parliament are determined that Mr. Arnold Morley, in the capacity of Postmaster-General, shall have little peace until something definite and decided has been accomplished in respect of the agreement between the Government and the National Telephone Company.

Captain Bagot last week asked Mr. Morley whether, as a matter of fact, this agreement had not been in preparation for two years, and whether he could make a promise as to the date upon which the said agreement would be laid before the House. Also he asked—and this is a very important point—whether he was aware that the effect of the long delay in concluding the agreement, and the refusal of the Post Office in the meantime to grant licenses to municipalities, had been to enable the company to increase their monopoly, and place themselves in a better position than those boroughs which wished to obtain licenses; and if he could state how many applications for local licenses from municipalities had been received since it was decided to purchase the trunk lines. Mr. A. C. Morton and Mr. Henniker Heaton asked questions on the same subject. Mr. Morley, in reply, said that since April 30th, when he answered a question respecting the agreement, further points of considerable complexity had arisen in connection with the settlement of details. The delay was not due to any absence of effort on his part, and he could not think that the delay had enabled the Telephone Company to increase their monopoly, or place themselves in a better position than those municipalites which wished to obtain the licenses. The hon. gentleman seemed to forget that the company only enjoyed a temporary license, terminating in 1911, and every month that passed must have the effect of reducing the value of their property. The agreement which was being negotiated was simply to give effect to that made by the late Government for the purchase of the trunk lines, and did not involve interference with existing licenses.

Assuming Mr. Morley's reply is correctly reported, his argument as to "every month reducing the value of the property" appears to us very illogical. Because the license expires in the year 1911, it does not necessarily follow that the company's service at that date will be worth less than it is now. We do not know the exact nature of the pending agreement, but the company have 17 years yet to run under license, and if they continue to extend and build up their

business in the future as they have done during the past few years, it will require an opposition far greater and more expensive than the British Government will be disposed to create and maintain, to cause any very material depreciation in the value of the National Company's undertaking.

There will be two courses open to the Government in 1911 if the business then remains unpurchased. It will either have to refuse renewal of the license, and build up a new and separate service all its own, or pay over to the company a fair and proper price to, be agreed upon, for its business. The first course would be almost impracticable, for we believe that 17 years will effect very great extensions in the use of the telephone. If the Government intends to purchase—the likelihood of which the delays lead us to question—the best time for such negotiations to be brought to some settled issue is undoubtedly the present, for as the service grows, the difficulties connected with the creation of a competitive service must inevitably increase. By the uncertainty of the repeated delays, which we have reason to believe are due more to the Government than the other party, the latter are seriously handicapped. The sooner the matter is settled one way or the other, whatever the agreement may be, the better it will be for everybody, though from this statement doubtless Mr. Morley will except the present Government.

BOULOGNE AND BACK IN A DAY.

The great success which last year attended the efforts of the Victoria Steamboat Association, Limited, to provide cheap excursions on the Thames and its estuary is likely to be more than maintained in the coming season. Last autumn, the "Palace Steamers, Limited," was formed to co-operate with the Association in conducting a service "to Boulogne and back in a day, calling at Margate both going and returning." To do this successfully a vessel of great speed and power was necessary, and the Fairfield Shipbuilding and Engineering Company, Limited, the builders of the *Koh-i-Noor* and *Royal Sovereign*—vessels already well known and popular on the Thames—were entrusted with the contract. The vessel was, on April 23rd, launched from the company's yard at Govan, Glasgow. She is 330 feet in length between perpendiculars, and 40 feet in breadth, an extreme breadth of 73 feet, with a moulded depth from the upper deck of 21 feet 6 inches. The hull is of steel throughout, and all the structural scantlings have been approved by the Board of Trade, whose officials have taken a special interest in the vessel, in view of the fact that she is much in advance of any previous excursion steamers both in regard to general arrangement and to the nature of the contemplated service. The hull, as in the *Royal Sovereign* and *Koh-i-Noor*, is divided, in accordance with the recommendations of the Bulkhead Committee, into 11 principal water-tight compartments. The steel bulkheads thus introduced strengthen the structure considerably, by acting as supports and ties between the decks and framing, in addition to rendering the vessel practicably unsinkable. These bulkheads are fitted with water-tight doors, worked from the main deck, and ready at a moment's notice to be closed. To assist navigation in harbours, where space is limited, a bow rudder is fitted. It is operated by screw steering gear on the upper deck, and is supplied with a locking attachment for keeping it in place when the vessel is steaming ahead; it is also fitted to be steered by steam. Steam steering gear is fitted in the engine room for controlling the after rudder—a powerful hand gear, of course, being aft in reserve. A steam capstan and windlass is on the upper deck forward, and a steam capstan aft for mooring and warping purposes. The vessel has four decks, designated respectively the "lower," "main," "upper," and "promenade," the latter extending from the stern three-fourths of the steamer's length, on which is a plentiful supply of life raft-seats, but giving ample accommodation for promenading, the deck being free of erections with the exception of the funnels, captain's chart room, and wheel-house, over the top of which is again a flying bridge from where the vessel is steered in and out of port in good weather, the wheel house being reserved for dirty weather. On the flying bridge are a plentiful supply of telegraphs, gongs, and speaking tubes, enabling the captain to communicate with any part of the vessel, and also enabling him to be communicated with on the darkest and stormiest night without the necessity of shouting, thereby ensuring absolute control of his vessel. As is usual in paddle steamers, the engine-room divides the classes, the first-class passengers having all the promenade deck and the after part of the vessel to themselves. Here the dining saloons are fitted on the main and lower decks. The promenade deck, as before mentioned, is unbroken by any erections except the wheel house and chart room necessary for navigating the vessel. These are in a neat teak deck house under the captain's bridge. The second class dining saloon is on the lower deck, and the accommodation also includes a deck saloon, with ladies' cabin and a smoking and refreshment room. The immense breadth of beam, whilst serving the purpose of making the vessel have exceptional stability, also gives a feeling of "spaciousness" not common on board ship; the effect of the large square side-ports in giving ample light and air, as well as in improving the general appearance, is also very marked.

The electric lighting has been carried out in a most careful and thorough manner by Mr. Wm. Mackie. The dynamo is an overtype slow speed machine, coupled direct to a Robey vertical engine, governed by a Pickering governor. The whole combination had to be made as compact as possible, to enable it to be fixed in the place allotted to it in the engine room, the only space available being a small corner. The machine has a very massive wrought-iron field, and altogether is of excellent design and workmanship, running cool, and absolutely sparkless at all loads.

The wiring is double wiring, in wood casing. Feeders are run direct from the engine room switches to each section of the ship, and in each section is placed another switchboard, to which every lamp in that section is connected directly to a bus bar and switch. This is an excellent method of wiring, and does away with all joints to be soldered; faults are easily located, and cut out without interfering with more than one or two lights. The subsidiary switchboards are fixed in the panelling where possible, with hinged covers, and all connections are made by screws.

On the bridge two small incandescent lamp projectors are fixed. By means of these the gangways and landing stages can be efficiently illuminated at night while landing or embarking passengers. The installation is very complete, and well designed.

On Saturday last we, together with a large party, made the round trip, Tilbury to Boulogne and back. At Boulogne the Mayor of that French seaport and a party visited the ship, and toasted success to it. The steadiness of the ship, and the entire freedom from rolling, was remarkable, and the accommodation on board is palatial.

ECONOMICAL STEAM ENGINES AND WASTEFUL BOILERS.

According to one of the speakers in the discussion on Mr. Crompton's recent paper, viz., Mr. Rosenthal, Lancashire boilers in Lancashire factories only give an evaporation of 6 to 7 lbs. per pound of coal. Now the ordinary Lancashire factory with compound steam engines secures a horse-power hour for 1¾ lb. of coal, from which it follows that compound engines use only 10½ to 12 lbs. of steam per horse-power hour. If, therefore, Mr. Rosenthal be correct, it would be found possible, by the exercise of that "great skill and unwearying attention" spoken of by Mr. Crompton, to get 1 horse-power hour from only about 6 lbs. of steam. Mr. Rosenthal should make further inquiries into the practice of the ordinary co-operative concerns in coal consumption, for his figures won't stand criticism. He makes the further error of classing Lancashire, water-tube, and ordinary tubular boilers on the same plane as regards smoke prevention. Now there is absolutely no similitude whatever. The water-tube boiler resembles the upright boiler in these respects, for in both, the flames and gases from the furnace rise vertically from the fire surface, whereas in the Lancashire, the marine, the underfired, and similar furnaces, the gases sweep along the fire surface and mingle at one common area over the bridge, and it is just this important difference that

non-experts entirely overlook. Take for example the locomotive boiler *without* a brick arch, and where can there be found a boiler that produces smoke so freely. The furnace is of the same class as that of the vertical or water-tube boiler. Add the brick arch, and at once there is introduced an entirely different *régime*, for the brick arch gives in effect the common commingling point of the flue boiler and smokelessness results.

In Broadbent's modification of the vertical boiler an immense improvement is effected as regards smoke, simply because the above principle is carried into effect. The Lancashire and marine boilers are correct in form for smoke prevention, but they are wrong in material, for they have water-cooled combustion boxes. The ideal boiler, so far as we can read the results of practice, is one with the whole or a great part of its furnace lined with firebrick, and with Servé ribbed tubes beyond the flaming point. Experience alone could decide how far to carry the brick lining, but from the fact that even now with care Lancashire boilers are smokeless, it is only a matter of adding a margin to cover the mistakes of the fireman. If makers of water-tube boilers could divorce their minds from the vulgar error that a furnace must be hugged by cold surfaces, and would redesign their boilers on sounder lines, they would probably beat the Lancashire boiler at all points except that of steady steaming, which they can only secure by adding to their water capacity, and the power to use dirty water when this is compulsory. Unless they will do this they will continue to demand costly smokeless fuel, which is of all fuels most distant from the majority of the power-using centres of this country.

It will be noted that while Mr. Crompton has said much on the subject of forcing boilers, he has, even in his corrected reply, not given a single figure bearing upon the rate of fuel combustion per foot of grate. Vague generalities about doing 50 per cent. beyond its normal power tell nothing. The normal horse-power of a Babcock boiler is based on 30 lbs. of steam per horse-power hour; put such a boiler to drive a 15-lb. engine, and at once it is doing 100 per cent. beyond its normal.

It is simply begging the question to omit the amount and rate of coal consumption when bragging about results in forcing a boiler. Rated horse-power is simply a later form of the old nominal horse-power—utterly valueless. Of what possible good can it be to talk in one breath of a boiler horse-power which means 30 lbs. steam, and a Willans, Sulzer, or other modern engine horse-power which means 12 lbs. of steam, more or less.

We had hoped that the nominal horse was a dead one, and little to be expected at a meeting of electrical engineers. It is to be regretted that Mr. Crompton in his reply adheres to the statement that an economiser can cover a stoker's mistakes. The idea is as mischievous in practice as it is erroneous in conception. Never mind, we are told in effect, how cold you allow the furnaces to become, so long as you have an economiser to take the heat up—to absorb heat never generated!!! When the stoker is firing badly, he is wasting no heat to the economiser—he is not producing any heat to waste. How then can the economiser pick up what has not been dropped? Bad firing is bad for every class of boiler, and equally so for the feed heater, and Mr. Crompton's ideas on this question are entirely opposed to all known physical facts, and it would be interesting to have him explain how he arrives at his conclusions.

We should also like to know the square foot rate of coal combustion. Figures of bituminous coal combustion in a marine type of boiler have recently appeared in these columns, and no one can form the slightest idea of what is meant by forcing a boiler unless the fuel consumption is given. We are told that a boiler 9 feet wide turned out 600 H.P. What were the engines consuming in water, and what was the furnace area? A Lancashire boiler, with a furnace width of 6½ feet only, will give 500 H.P. with compound engines, so that the above 600 H.P. with probably triple expansion engines counts for nothing as a forcing test, and no argument can be based on figures of this sort.

Eastbourne Parish Church.—An electric light installation is being fitted to this fine church.

CORRESPONDENCE.

Test of Reckenzaun Tramway Motors and Gearing.

Having been in America for the past month, I have but just seen Mr. Rankin Kennedy's criticism of my paper relative to certain tests of Reckenzaun motors and gearing.

In making the rough tests referred to, I supposed the efficiency of the machine, whether used as dynamo or motor, to be the same.

The ratio of output to input represents the square of the combined efficiency of a motor and its gear, disregarding any loss due to belting, one motor and gear being used to drive the other motor (through its gearing) as a generator.

It was to allow for loss of power in the belts connecting the two gears, that the square root was divided by 0·93.

The tests referred to as made by Mr. Reckenzaun were upon a 4 H.P. gear.

The motors used at Leeds were designed for 10 H.P. There was no necessity to test them to 20 H.P.

Worm gearing must be designed with reference to the power to be transmitted. If that power be greatly exceeded efficiency decreases.

Having no data with me, I must defer any further answer to Mr. Kennedy's letter until my return to London.

Philip Dawson, A.I.E.E., &c.

Muirhead and Others v. Commercial Cable Company.

The attention of our clients, the plaintiffs in the above action, has been called to a letter signed by Mr. Ward, Vice-President of the defendant company, published in your number of the 15th inst, and we are instructed to call your attention to the fact that an appeal by the defendant company is now pending and will shortly come on for hearing.

Under these circumstances the impropriety of any correspondence from the parties appearing in your publication is obvious, and we must call your attention to the fact that the publication of such correspondence while the matter is still *sub judice* is quite unjustifiable, and ask that you will abstain from publishing further letters upon the subject.

We should have written you earlier but that our attention had not been called to the matter.

We have purposely abstained in this letter from dealing with the actual statements made in Mr. Ward's letter, as we do not wish to continue the impropriety of the original publication, but you will, of course, understand that our clients do not admit the accuracy of Mr. Ward's statements.

Trinder & Capron.

[We exceedingly regret that occasion should arise for the receipt of this letter. We thank Messrs. Trinder & Capron for calling our attention to the matter, for we are generally so very cautious in things of this kind. In publishing Mr. Ward's letter, the fact of an appeal being in progress was for the moment overlooked.—Eds. Elec. Rev.]

A Complaint.

In reply to "Electro's" letter in your issue of the 8th inst., I can hardly see how he thinks my letter of the 1st vague, when he answers that engine-drivers, fitters, carpenters, &c., take charge of installations and dub themselves "electricians." He seems to know this, yet will wonder who is to blame. I again answer that firms of electrical engineers or their travellers are, and I repeat that they do recommend, incompetent men. I had one of these noble gentlemen call upon me a little time ago, and he (not knowing I had any knowledge of electricity) began at length to give in detail the "simplicity" of working the same. He said, patting me on the back, "Oh, my dear sir, we can reduce your lighting bills considerably; the plant we should put down would take up 'no' room, and a man (a man mark you) at 18s. per week could do all that is required."

This was from one of our very best firms who were contracting for 2-400 light dynamos, 2-20 H.P. motors, 8 arc lamps, and a number of incandescent lamps.

(Query—What sort of a man, and what would the plant be like in a few months?)

This is only one of many examples I could give, if space would allow, where such men have been adopted, and their subsequent conduct and results. I am not advising or writing for "Defence not Defiance," as I am in no love with trade unions, but believe in approaching masters in a quiet way, and I make here a suggestion to firms that they should keep a list of men they can rely upon, who would do them justice and credit, and recommend them to their clients instead of the eighteen shilling ones.

George Kenyon.

ELECTRIC LIGHTING PROVISIONAL ORDERS (No. 3) BILL.

MEMORANDUM STATING THE NATURE OF THE PROPOSALS CONTAINED IN THE PROVISIONAL ORDERS INCLUDED IN THE ELECTRIC LIGHTING PROVISIONAL ORDERS (No. 3) BILL.

Crystal Palace District Electric Lighting Order, 1894.

The undertakers under this order are the Crystal Palace District Electric Supply Company, Limited.

The area of supply is portions of the district of the Beckenham Local Board, the borough of Croydon, the parish of Lambeth, the district of the Lewisham District Board of Works, and the parish of Camberwell.

The order is to be read in conjunction with the Crystal Palace and District Electric Lighting Order, 1890, and varies the area of supply authorised by that order; the order also provides for the revocation of the Crystal Palace District Electric Lighting Licence, 1893.

Oswestry Electric Lighting Order, 1894.

The undertakers are the Oswestry Electric Light and Power Company, Limited.

The area of supply is the borough of Oswestry.

The order contains provisions—

1. That the undertakers shall lay down mains in certain specified streets within a period of two years, and it provides for the supply of electrical energy in the remainder of the area on certain specified conditions.
2. For the deposit of a certain sum as a guarantee that the works shall be completed.
3. For the audit of the accounts of the undertaking.
4. For the approval by the Board of Trade of the system upon which energy is to be supplied, and the issue by them of regulations for securing the safety of the public, and for ensuring a proper and sufficient supply of energy.
5. For the execution of the necessary works and the breaking up of streets, &c., and the alteration of pipes, &c., under streets.
6. For regulating the manner in which energy is to be charged for, and fixing the maximum price to be charged.
7. For the appointment, remuneration, and duties of electric inspectors, and the testing of electric lines and other works, and for holding inquiries by the Board of Trade as to the causes of accidents affecting the public safety.
8. For the supply, use, certifying, inspection, &c., of meters.
9. For the revocation of the order under certain circumstances.

The order also contains a provision for the purchase of the undertaking by the local authority after the expiration of 35 years from the commencement of the order, on certain terms specified in the order.

Plymouth (Corporation) Electric Lighting Order, 1894.

The undertakers are the Corporation of Plymouth.

The area of supply is the borough of Plymouth.

The order contains provisions that the corporation shall lay down mains in certain specified streets within a period of two years, and it provides for the supply of electrical energy in the remainder of the area on certain specified conditions.

The order also contains provisions—

1. For the approval by the Board of Trade of the system upon which energy is to be supplied, and the issue by them of regulations for securing the safety of the public, and for ensuring a proper and sufficient supply of energy.
2. For the execution of the necessary works and the breaking-up of streets, &c., and the alteration of pipes, &c., under streets.
3. For regulating the manner in which energy is to be charged for, and fixing the maximum price to be charged.
4. For the appointment, remuneration, and duties of electric inspectors, and the testing of electric lines and other works, and for holding inquiries by the Board of Trade as to the causes of accidents affecting the public safety.
5. For the supply, use, certifying, inspection, &c., of meters.
6. For the application of moneys received by the undertakers in respect of the undertaking.
7. For the transfer to any company or person of the powers, duties, and liabilities of the corporation under the order by means of a deed to be approved by the Board of Trade, upon such terms and subject to such exceptions and modifications (if any), and for such period, as may be specified therein.
8. For the revocation of the order under certain circumstances.

Shropshire Electric Light and Power Company Electric Lighting (Shrewsbury) Order, 1894.

The undertakers are the Shropshire Electric Light and Power Company, Limited.

The area of supply is a portion of the Borough of Shrewsbury.

The order contains provisions similar to those referred to and numbered 1 to 9 in the case of the Oswestry Electric Lighting Order, 1894, before mentioned.

The order also contains provisions:—

(*a*) For the purchase of the undertaking by the local authority after the expiration of 21 years from the commencement of the order or any subsequent period of seven years, on certain terms specified in the order.

(*b*) For the revocation of the Shropshire Electric Light and Power Company's Licence, 1893.

Wakefield (Corporation) Electric Lighting Order, 1894.

The undertakers are the Corporation of Wakefield.

The area of supply is the City of Wakefield.

The order contains provisions similar to those referred to in the case of the Plymouth Corporation Electric Lighting Order, 1894, before mentioned.

Yeadon Electric Lighting Order, 1894.

The undertakers are the Yeadon Local Board.

The area of supply is the urban sanitary district of Yeadon.

The order contains provisions similar to those referred to in the case of the Plymouth (Corporation) Electric Lighting Order, 1894 before mentioned.

ELECTRIC LIGHTING OF A WEST END MANSION.

ONE of the largest and most interesting private wiring contracts carried out in the West End has recently been completed to the entire satisfaction of the Baroness Burdett-Coutts and Mr. Burdett-Coutts, whose mansion at 1, Stratton Street, and 80, Piccadilly, is lighted throughout by the incandescent system, the current being supplied from the mains of the Westminster Electric Supply Corporation. The total power of the lights in the two buildings is equivalent to over 10,000 candles. Lamps of 2½, 5, 8 and 16 C.P., the equivalent of 360 16-C.P., are distributed throughout the various rooms of 1, Stratton Street, and the equivalent of 290 16-C.P. distributed in a similar manner over 80, Piccadilly.

The supply enters the house from the Westminster Company's mains through a three-pole cut-out, from which the current runs on to two meters on the three-wire system; the outside wires are 19/14s, and the inside wires 19/16s. These are taken to a three-pole double-break switch, from which the various wires for the house are split up on a distributing board. Each of these wires runs to its own fuse-box—of which there are ten—at Stratton Street. From the distributing fuse-boxes the various lamp circuits run, no lamp circuit carrying more than 5 ampères.

Both buildings are lighted on the same system, and there are a number of exceedingly novel features in the installations. The absence of new electric light fixtures and fittings is very noticeable, as in nearly every room the immense and ancient cut glass chandeliers formerly used for lamps or candles—but not for gas, as that has never had a place in the mansion—have been carefully altered by Messrs. Perry, of Grafton Street, at a cost of several thousands of pounds, to make them suitable to receive the electric light wires and lamps. Within the centre of the chief chandeliers are secreted by cut-glass curtains a number of lamps, to prevent the filament of the lamp reaching the eye direct, and the effect of the light shining through the glass lustres, shedding forth a variety of colours, is exquisite, and has evoked feelings of great satisfaction from the Baroness, her husband, and everyone who has yet viewed the mansion in its improved condition. The light greatly enhances the splendour of the lavishly furnished apartments, and reflects great credit upon all who have had anything to do with the work. It was at first thought that frosted globes would be suitable, but after experiment it was decided to have all the lamps enveloped in cut-glass globes; this, however, does not in any way lessen the brilliancy of the lustres, although it does away with the glare accompanying ordinary glass lamps. On cut-glass candelabras, where the usual silk shades would have been out of harmony, shades of cut-glass have been used in the form of an inverted tulip. The wires are fastened to the exterior of the candelabra and chandeliers by fine silk bindings, and are themselves covered with silver-covered silk, so that it requires a close scrutiny to detect them. Over some, and below others, of the large and valuable oil paintings and works of art lights are placed, shades of tasteful colours showing the light on them at a favourable angle. Notwithstanding the fact that the old fittings remain in use, thus saving the cost of new ones, the total cost of the wiring and fitting contract amounted to over £1,200. The arrangement of the fittings was in the hands of Mr. Victor Middleton, electrical engineer, of Victoria Street, in conjunction with Mr. Burdett-Coutts, and Messrs. Townsend and McIntyre, of Brook Street, W., were the contractors, who have executed the work so admirably. The Baroness should, during the London season, be a good customer of the Westminster Electric Supply Corporation, for the quantity of current consumed when all the lights are on is very considerable. Messrs. Townsend have also lately carried out a number of other wiring contracts, among them

being 160 lights for Colonel Vivian, 15, Grosvenor Square; 19, Portland Place, for the Countess Charleville; 6, Rutland Gate, for Mrs. Foster; Pontywall, Towgath, for W. R. Crawshay-Ralston. They are also at present engaged lighting the Southport Infirmary and the offices and factory of Messrs. McIntyre, Hogg, Marshall & Co., of Londonderry, and a number of smaller contracts are engaging their attention.

LEGAL.

Woodhouse & Rawson United, Limited.

Public Inquiry before Mr. Registrar Hood.

(*Continued from page* 732.)

The public inquiry into the promotion and management of this company was resumed on Wednesday last before Mr. Registrar Hood at the London Bankruptcy Court.

On the case being called, Mr. H. G. Rawson, on behalf of the directors, stated that certain documents which the Official Receiver had alleged to have disappeared had been put in. As a matter of fact, the papers in question had never been removed from the place where they were usually kept, and the directors considered they had a right to complain that such a suggestion had been made.

His Honour observed that in his judgment the Official Receiver had conducted his examination with perfect fairness and impartiality, and the inquiry was then proceeded with.

Mr. F. W. Pixley was again called, and in answer to Mr. McKaye, stated that he intended the special report attached to his certificate of July, 1892, to be taken as part of the certificate. The reason for the report being attached was, that on this occasion he had come to the opinion that the accounts were incorrect, which he had not believed to be the case before.

In answer to Mr. Pilling, the witness said he assumed that the accounts of Woodhouse & Rawson, Limited, were prepared under the direction of Mr. F. L. Rawson. All information which he required as to the balance-sheet of 1890 was furnished by Mr. Rawson, and the various items were compared in the usual way with the entries in the books. He considered that the amount entered as the goodwill of the United Company represented the goodwills of all the businesses. He was aware that in the original accounts the goodwill and patents of Woodhouse & Rawson, Limited, were represented by 100 founders' shares of £1 each, but there was also £20,000 in cash and £30,500 in fully paid shares.

Mr. Pilling observed that in the United Company's balance-sheet the patent rights were returned at £64,000, and the goodwill at £75,000.

The Witness replied that he knew nothing about these figures. He had no knowledge as to what was realised under the liquidation of Woodhouse & Rawson, Limited. The sum of £37,325 returned as a profit in respect of the International Okonite, Limited, was included in the balance-sheet upon the advice of counsel. He (witness) certainly considered that all the profits included in the balance-sheets had been earned, but as a matter of fact the dividend was not necessarily paid out of those profits, as a dividend had been guaranteed in any case.

By Mr. H. G. Rawson: He had never withdrawn any report which he had proposed to make until he had been satisfied that the objections he raised were unfounded.

In answer to the Registrar, the Witness said that the goodwill of a company was usually fixed in the original prospectus, and remained at the figure at which it had been taken, whether the profits of the business increased or decreased.

Mr. Stewart asked whether witness did not consider it his duty, as auditor, to inform the shareholders in some way or other that the industrial business was being carried on at a loss, and that the profits made were realised on the financial business.

The Witness replied that, in his opinion, it was not his duty to do this, but the fact was referred to at every yearly meeting, and in the reports of these sent out to the shareholders. The financial part of the business was an outcome of the industrial one, and it was believed by the directors that it would prove to be the more profitable branch of the two. The witness proceeded to make a lengthy statement with reference to his action as auditor of the company. He pointed out that although he had acted as auditor of Woodhouse & Rawson, Limited, he declined to undertake the special investigation of the accounts for the purposes of the amalgamation scheme. Although a reference was made to the profits shown by the audited accounts of Woodhouse & Rawson, Limited, none whatever was made to his (witness) being the auditor, and if any intending applicant for shares had taken the trouble to call for the accounts, he would have ascertained that they were accompanied by a special report from the auditors. His (witness's) only clients were the shareholders of Woodhouse & Rawson, Limited. At the same time, although he declined to accept any responsibility in regard to those who might subscribe to the new company, he had no reason to doubt that the profit referred to on the prospectus was correct, and would ultimately be realised. As regards the subsequent prospectuses inviting subscriptions for debentures and shares at a premium, he was never consulted upon them, and did not see them until after their issue. As regards the balance-sheet of June, 1890, every item was carefully investigated, and the accounts when first presented to him varied from those ultimately certified. For example, nothing was written off the patents until he pointed out that this should be done, the result being that £7,421 was charged against the profit and loss account. A great deal of evidence was also produced to him as to the value put by the directors upon the assets. There was included among the debtors a large sum from the International Okonite Company. Having regard to the fact that the public were subscribing for the shares at par, and that a director of Woodhouse & Rawson United, Limited, was a member of the board, and therefore likely to know the value of the shares, witness considered that he should have done wrong to have thrown doubts upon the value of them in the balance-sheet, viz., the par value. There was, moreover, a reserve or surplus after the payment of the interim and proposed dividends, of £49,867, and after interviews and correspondence with the solicitors of the company, and obtaining the opinions of eminent counsel on some of the important points, he was satisfied that it was his duty to pass the accounts. Coming to the balance-sheet of July, 1891, the witness said that many alterations were made in the accounts, as the result of the draft certificate forwarded to the directors. In this attention was called to the fact that nothing was written off patents or patent rights, and charged against profit and loss. The accounts ultimately signed showed a sum of £4,156 written off for depreciation of patents. Witness also received an undertaking from the directors that the amount due from Mr. Rawson should be paid off, and it was also pointed out that the vendor company being indebted to Mr. Rawson personally, the company had full security. On calling attention to the fact that the profits on the financial and industrial businesses were not separated, he received a pledge that reference should be made to the financial business in the directors' report, and this pledge was fulfilled with regard to the investments; the Stock Exchange official list was produced to him in support of the directors' valuation. With the exception of the Phœnix Trust, the companies whose shares were referred to were not launched to promote schemes brought to the company as promoters. They were the results of scientific work and experiments made by the company's own engineers in their own workshops. With regard, however, to the accounts of July, 1892, witness found that the books were in confusion; that the anticipations of the directors as to the sale of the shares were not being realised, and that money was being borrowed at high rates of interest. He therefore came to the conclusion that he could not sign those accounts, and made a special report to the shareholders as to the unsatisfactory state of the company's affairs.

Sir JOHN STOKES, K.C.B., was next called, and, in answer to Mr. Stewart, said that he was a director of Woodhouse & Rawson, Limited, and afterwards became liquidator of that company. He had a considerable number of shares in the company, and to that extent was interested in the amalgamation with the United Company. As regards the patents to be acquired by the new company, they certainly obtained all the patents which were not reserved in the agreement. He (witness) did not take part in any meetings of the board until after allotment. He was regarded by the other directors as representing the interests of the former company, which he was also bound to do as liquidator. He did not personally make any enquiry into the position of the businesses which were acquired, or of the assets taken over from them. He left the investigation of this matter to the other directors, all of whom were competent to deal with it. He had no knowledge that certain of the businesses were wholly insolvent. It was true that certain of the other directors retired before allotment, but he did not understand that this was owing to any dissatisfaction as to the state of the businesses. He did not see the balance-sheet of the Manufacturing Company for June, 1889, and did not know that it showed an accumulated loss of over £44,000. Part of the assets of the limited company consisted of an option to call certain Elmore shares, and of the profit returned in the first balance-sheet, nearly £30,000 was in respect of these shares. As liquidator of the limited company, he was anxious to obtain the return of the guarantee fund of £75,000. He took part in the board meetings of the United Company at which the question was discussed, and did not consider that his position as liquidator of the old company was any bar to his doing so. He considered that he was promoting the interests of the shareholders of both companies in urging the return of the guarantee fund, as the larger part of the profits was being absorbed by the holders of founders' shares, and he (witness) wished to make it available for all the shareholders. He understood from the first that the United Company was to carry on a financial as well as an industrial business. He was aware that a large amount had been lost on the shares of the various companies, but he did not admit that the deal in Elmore shares was the only successful venture undertaken by the Limited Company. With regard to the United Company, he did not think its only successful operations had been the sale of part of the premises at Kensington to the Kensington Co-Operative Stores, which returned a profit of £17,000, and another option to take Elmore shares, upon which a profit of £20,000 was divided. Questioned as to the sum of £35,145, shown as profit on the promotion of the Epstein Accumulator Company, the witness admitted that the whole amount existed merely in securities of that company. The United Company, however, had given £4,000 for a half share in the patent, and had spent from £11,000 to £12,000 in promoting it, and considering the expense and trouble that had been incurred in connection with the matter, he did not think the estimated profit was excessive. He did not know whether the opinion of any expert had been taken as to the value of the patent, but the members of the board were all capable of forming their own opinion upon the subject. Mr. Rawson's claim for £12,000 was discharged in December, 1892, by the surrender to him of £25,000 worth of 5½ per cent. debentures in the United Company. In January, 1890, a prospectus was issued, in which the directors stated, among other things, that owing to the successful working of the company since its formation, an interim dividend had just been paid at the rate of 15 per cent. on the ordinary shares, and 8 per cent. on the preference shares. He could not say what profits were specially referred to in this prospectus, but he did not admit that the only source

from which they could be derived was the transaction in Elmore shares. After the lapse of five years he could not be expected to remember the reasons which induced him to consider that profits had been earned. He denied that there was any special motive for making the third issue of shares coincide with the payment of the interim dividend. Up to January, 1892, he was not aware that Mr. Albert Grant was connected with the Phœnix Trust, of which Mr. F. L. Rawson was a director. He did not know that any independent information was obtained as to the value of particular shares, and he could not at the present moment point to any such valuation.

By Mr. Stirling: The prospectus of February, 1891, offered, among other shares, £100,000 5½ per cent. debenture stock. He was not aware that no trust deed and no stock was in existence until the following July. He was present at the meeting of December, 1892, at which the secured debenture stock of £20,000 was confirmed. The £20,000 was to be raised on the security of the floating assets of the company. At that meeting a committee of shareholders was appointed to investigate the affairs of the company, and their report was published in March, 1893, together with observations by the directors. He (witness) was consulted as to these observations, and accepted responsibility for them.

Further examined by Mr. Stewart: The witness said that he had nothing to do with framing the prospectus, and did not see it until after it had been issued.

By Mr. Pilling: He did not associate himself with the estimated profit of £75,000 shown in the first prospectus as the result of the last year's trading of the Limited Company, but he was not in a position to say that the estimate was a "prodigious blunder." As liquidator, he did not find that nothing was realised out of these profits, and in that capacity he received and distributed the £75,000 worth of debentures.

By Mr. G. W. Rawson: As a director, he did not vote upon any question in which the interests of the two companies were opposed. In addition to the amounts appearing in the books as the cost of the various patents, other large sums had been spent in the way of salaries, &c., in increasing their value. He attributed the failure of the company largely to the depression in financial business, owing to which the directors were unable to bring out companies to take up valuable patents.

In reply to Mr. Jenkins, the Witness said that he devoted a great deal of attention to the industrial part of the business, and formed his own opinion as to the value of the various inventions brought before the directors. With regard to the value put upon shares in the various balance-sheets, he relied upon the information given to him by the managing director.

Mr. Dundas, the next witness, said that he had been secretary of the company since its formation. The minutes were entered up by him after being revised by Mr. Rawson. He was not present at the meeting at which the directors proceeded to allotment, and therefore could not state upon what grounds this decision was come to.

The Court then adjourned.

The examination was continued yesterday. Lord Aberdare and Mr. A. Hoster being examined, the Court adjourned until Wednesday next.

NOTES.

Telephone Induction Coils.—At a recent meeting of the Montefiore Institute, M. Piérard read a paper on "The Rendering of Telephone Induction Coils." As the result of experiments, he comes to the conclusion that—1, the rendering of a telephone induction coil, for telephonic currents, does not appreciably vary with the charge; 2, the rendering is small, and does not appear to reach 50 per cent.

Kingston Electric Lighting.—At a meeting of the Kingston Town Council last week, the Lighting Committee reported that the Town Clerk had submitted a letter from the Local Government Board in regard to the application for a further loan of £6,000 for electric lighting purposes, stating the particulars that would be required for the Board's consideration, the same to include the plans and estimates. The consulting engineer had submitted the estimates, and was instructed to prepare the necessary plans.

The Theoretical Value of the Ohm.—In a note of M. A. Leduc, presented to the Académie des Sciences, the writer states that the theoretical value of the ohm to be that of a column of mercury 106·32 cm. long and 1 mm. square section at 0° C. He arrives at this result from an examination of a determination by M. Wuilleumier, which gives the length as 106·267. This latter dimension M. Leduc points out is due to an error which, when corrected, gives the higher value, which is one closely in accord with that of Rayleigh, Kohlrausch, Rowland, Mascart and others.

Fareham Electric Lighting.—The Fareham Electric Light Company have agreed to accept the Local Board's offer of £5,000 for the purchase of their works, and an additional £1,000 for laying certain wires underground, and providing a new engine. On receipt of the company's letter, the Local Board considered the matter again; but judging from the remarks of several members, they do not seem very anxious to stick to their offer. After a lengthy discussion it was arranged that, pending the application to the Local Government Board for permission to borrow the necessary loan, the clerk should see to the preparation of the contract for the purchase of the electric works, and that it should be considered either at a special meeting or at the next ordinary meeting of the board.

The Northern Society of Electrical Engineers.—On Saturday last, the 23rd inst., a party consisting of about 40 members paid a visit to Liverpool. The party was received at the Oldham Place Station of the Liverpool Electric Supply Company by Mr. A. Bromley Holmes, C.E., who explained all the points of interest. Members subsequently visited the Overhead Electric Railway, and inspected the generating station, permission having been given by Mr. S. B. Cottrell, the engineer for the company. The party then proceeded to the National Telephone Company's new switch room, where the system was very lucidly explained. The majority of the members dined together at the Alexandra Hotel, returning to Manchester in the evening, after having spent an instructive and pleasant afternoon. This is the first of a series of excursions to be made during the summer, the next one being to Antwerp on July 20th.

Telegraphy Extraordinary.—The Cape of Good Hope telegraph service has always been famous for the smartness of its operators. An excellent piece of work was done by three of the Cape Town staff on May 17th. The Cape Parliament was opened on that day, and the Governor's speech, reaching to a total length of 1,700 words, was telegraphed all over South Africa. To Kimberley it was sent in 35 minutes, or at the rate of 48½ words per minute, to King Williamstown in 40 minutes (42½ words per minute), and to Port Elizabeth in 41½ minutes (41 words per minute). All three circuits are key-worked Morse, with printers at the receiving ends. The tape upon which the received message was printed at Kimberley was carefully examined, and the signals were found to be well formed and good. Only judicious abbreviations were used, and therefore the message could be read without difficulty from start to finish, notwithstanding the fast manipulation. King Williamstown also read the message without a single stoppage, and but one trifling repetition was called for by Port Elizabeth. The Kimberley performance establishes a record for speed in key working. The sending operator on this line was a Mr. Harrison, who recently left the Imperial Post Office Service to enter that of the Cape.

The Electrical Conductivity of Gases.—In some recent researches by F. Braun on the electrical conductivity of gases, which are described in the *Zeitschrift für Physikalische Chemie*, several interesting cases were investigated. These may be divided into three heads, and the results of the observations were substantially as follows:—(1) *Compound gases at the moment of formation.* The gases studied were mixtures of nitric oxide and air, and of chlorine and hydrogen; these were caused to unite under the influence of heat or diffused daylight. A Leyden jar battery of about 4,000 volts E.M.F. was employed, but no conduction was observed. (2) *Gases during the time of explosion.* A mixture of carbon monoxide and oxygen was employed, and the current used was obtained from 7 to 20 small Grove cells. In this case there appeared to be undoubted conduction through the exploding gases. (3) *Gases at high temperatures.* The gases were heated to 1,000°—1,200° C., and the current used was obtained from a Leclanché cell. It was found that ammonium chloride and cadmium iodide conducted well; that ammonia, iodine, and hydrogen chloride conducted; that hydrogen iodide, hydrogen bromide, and mercuric oxide conducted slightly; but that carbon dioxide, steam and nitric peroxide, did not appear to conduct at all. These results in general confirm those obtained by De Hemptine, which were noticed in the Electrical Review last year.

Coventry Electric Lighting.—The Local Government Board has sanctioned the raising of a loan of £20,000 for electric lighting purposes.

Edinburgh Electric Lighting.—On Monday afternoon last the foundation stone of the central station, Torphichen Street, was laid by the Lord Provost, and in the evening a dinner was served in the Council Chambers. After the usual complimentary speeches, Prof. Alex. B. W. Kennedy delivered a lecture on "The Electric Light in Edinburgh."

Cable Matters.—Mr. Thomas Skinner, the chairman of the Halifax and Bermudas Cable Company and director of the Commercial Cable Company, has lately been interviewed by a representative of the *Canadian Gazette*, a weekly paper which has been devoting considerable attention to general cable matters of late.

Paris Universal Exhibition of 1900.—The Superior Commission of the Exhibition of 1900 has just arranged the general divisions of this exhibition. The fourth and fifth groups are set apart for the representation of the electrical industry. The fourth group is devoted to mechanical plant and general operations; it comprises classes 19, 20, 21 and 22, which include the mechanical production and utilisation of electricity, electro-chemistry, electric lighting, telegraphy and telephony, and the various applications of electricity. This classification at first sight seems very general and incomplete. We see no mention of electric traction, which is, however, of capital importance, unless it is included amongst the various applications of electricity or in the group designated "Means of transport." This branch is, however, quite as worthy of a special class in electricity as electro-chemistry.

A Gas-driven Tramcar.—A new claimant for favour as a means of economical tramcar propulsion is a gas motor, which was successfully tried at Croydon last Tuesday week. The motor, which is driven by compressed gas, is placed under the tramcar together with three cylindrical gas-holders. The machinery occupies the space under one of the seats of the car, whilst one of the gas-holders is carried under the opposite seat, the other two holders being placed transversely under the car framing. The three reservoirs will hold a sufficient supply of gas to serve for an eight-mile run. The car is about 18 feet long, and, with the machinery, weighs 5½ tons. It is driven from either end, there being a starting and stopping lever and a hand-brake on each platform. The motor, which is of the Otto type, and is specially constructed for tramway work, has a slow and a quick speed, but the latter cannot exceed eight miles an hour—the *maximum* speed allowed by the Board of Trade. The ignition of the charge in the motor cylinders is effected by electricity, and the cylinders exhaust into a condenser, so that no smell arises, and no public nuisance is created by the escape of the products of combustion into the atmosphere. The charging station is at the depôt of the Croydon and Thornton Heath Tramways Company at Thornton Heath, where an 8 horse-power Otto gas engine drives a compressor. By this latter the gas, which is taken from the gas company's mains, is pumped into a steel cylindrical receiver 25 feet long and 4 feet diameter, at a final pressure of 10 atmospheres as a *maximum*, or 150 lbs. per square inch. This plant is equal to the supply of five tramcars, the number which it is intended to place on the line at first. Five more are to be added in due course, when another compressor and receiver will be put down and will be driven by the present engine, which is of sufficient power for the purpose. From the receiver a pipe is laid down to the tramcar charging point, the cylinders on the car being charged in the same way as those of railway carriages are charged with gas for lighting purposes. The pressure in the tramcar cylinders is about eight atmospheres, or 120 lbs. per square inch at starting, and the cost of the gas used is stated to be 1d. per mile with a fully-loaded car. The trial, which took place on Tuesday last week, at the instance of the Traction Syndicate, Limited, was conducted, says the *Times*, without hitch or hindrance of any kind. The car is going into regular traffic at once, and the other four, completing the first set of five, are shortly to follow.

Electric Lighting of Shops.—Almost all the tradesmen in Crown Street and Northgate, Halifax, have given orders for the electric lighting of their premises.

The Lighting of St. Leonard's Sea Front.—To-morrow night the lighting of the whole of the sea-front from the Fish Market, Hastings, to the end of West Marina, St. Leonard's-on-Sea, will be inaugurated.

The Lighting of the Large Wheel at Earl's Court.—We are informed that the contract for the electric lighting of the large wheel at the Earl's Court Exhibition has been placed with Messrs. J. G. Statter & Co., Limited.

Obituary.—The death is announced of M. Edmond Carré, who from the first has manufactured the electric light carbons invented by his brother, M. Ferdinand Carré. M. Carré has been well known as a manufacturer of refrigerating apparatus on the ammonia principle, though he has been largely engaged in electrical work of all kinds. The carbons manufactured by him, which have a world-wide reputation, have been used to the extent of many millions of metres.

Transcontinental Telegraph Company.—A telegram from Lisbon, dated June 27th, says that an agreement has been arrived at between the African Transcontinental Telegraph Company and the Portuguese Government by which the latter engages to construct the telegraph line through the Portuguese sphere on the Zambesi, and will charge the company an annual rental for maintenance. There will be no telegraph station within the Portuguese sphere, and it is understood that the Government will make use of the Transcontinental Telegraph Company's material now on the spot, in order to prevent delay in proceeding with the work of construction.

Bristol Lighting and the Local Government Board.—A few weeks ago we referred to the delay of the Local Government Board in sanctioning applications for loans. The case of Bristol is one instance where the lighting of certain districts is blocked until the Local Government Board give the sanction for the borrowing of £24,650, about which the Inspector held a public inquiry on April 25th—over three months ago. The money is required for the purpose of effecting certain extensions, and these were wanted completed by the coming winter. Unless the sanction is given at once, there is not much probability of that wish being carried into effect.

A Comparison between Welsbachs and Arcs.—In the course of a paper read before the Western Gas Association, Mr. Highlands of Clinton, Ia., said:—"As some of you probably know we also supply gas to Lyons, a city of some 7,000 inhabitants, immediately adjoining Clinton. Lyons has a municipal electric light plant that also supplies domestic lights. This plant has been established some ten years, while the gas mains were only run three years ago. At the time we extended the gas mains there nearly all the stores and shops were using the electric light. We did not make any effort to displace the electric light, but instead, concluded we would see what a fair competition between gas at $1.75 per 1,000 and arc lights at $5.50 each per month would result in. For the first year or so, we did not do a great deal of business with the stores. A customer would use the gas through the summer and then put back the electric lights in the winter when the evenings were long. In the summer of 1893, we sent 50 Welsbach burners up there to see what they would do. We equipped one large jewellery store with them at our expense and then waited for results. And they have been surprising indeed; for to-day there is not one store in the city using electric lights, the Welsbach burners having entirely displaced them; but at the same time it has cut down our sales of gas and I do not know but that we had better let a few of the electric lights come back, if we can only get rid of the Welsbach burners. The burners are all that is claimed for them, and give our customers unqualified satisfaction; but the confounded things won't let any gas through them. This same jewellery store that was formerly using two arc lights, only used 3,000 feet of gas in December. After our experiment with them at Lyons, we would prefer furnishing electric lights, rather than Welsbach burners, in Clinton."

Electric Light Fittings at a Rental.—We understand that the Bolton Corporation will fit up houses for the electric light, and charge a rental for the fittings and wires. This system, if we remember rightly, has been adopted by one of the Newcastle companies, though with what success we cannot say.

The Health of Mr. Edison.—When papers disagree regarding non-political matters, whose statements are to be regarded as correct? There is something the matter bodily with Mr. Edison, but what it is, and whether or not that something is of a serious character, we do not know. One of the London papers says the physician attending Mr. Edison reports that "his illness has been caused by overwork and severe application to study, both day and night." Another daily says that while sitting in the porch of his residence his chair collapsed, and the wizard fell down four steps, sustaining certain injuries which are not likely to prove of a dangerous character. Possibly later information may set our mind at rest as to the exact nature of the illness, and whether either or both of the papers referred to are correct, whatever is the matter, we trust Mr. Edison will soon recover.

A Pension to Mr. Samuel Alfred Varley.—The Government have decided to grant to Mr. S. A. Varley a pension of £50 per annum.

NEW COMPANIES REGISTERED.

Electric Novelty Syndicate, Limited (41,440).—This company was registered on the 23rd inst. with a capital of £4,500, in £1 shares, to acquire a certain invention for "Improvements in electrical toys," also a certain invention being an electrical appliance or apparatus for indicating the names of stations on railways, and to enter into an agreement for this purpose. The subscribers (with one share each) are:—W. G. Wyllie, 43, Heathland Road, Stoke Newington, accountant; S. Pocock, Chase Lodge, Clapham Common, S.W., surveyor; J. A. Strachan, 86, Cannon Street, E.C., secretary; A. Nicholls, 53, Princess Road, Kilburn, gentleman; A. G. R. Mumford, Inns of Court Hotel, W.C., gentleman; E. G. Paris, High Street, Dulwich, estate agent; T. Goddard, 20, Aveley Road, Clapton, stockbroker. The first directors are L. J. Aylward, A. Gilbert, and A. G. R. Mumford; remuneration, half-a-guinea each for every board attendance. Registered by Rodgers & Co., 4, Walbrook, E.C.

Patents (Pioneer) Syndicate, Limited (41,404).—This company was registered on the 20th inst. with a capital of £10,000, in £1 shares, to carry on the business of bankers, capitalists, and civil, mechanical, and electrical engineers. The subscribers (with one share each) are: W. Thompson, 15, Queen's Road, N.W., gentleman; H. W. Ibbotson, The Roost, Sheffield, gentleman; F. S. Thoms, Chandos Chambers, W.C., consulting engineer; E. Field, Chandos Chambers, W.C., consulting engineer; J. A. E. Hickson, 13, Abchurch Lane, E.C., gentleman; E. T. Read, 58, Lombard Street, E.C., merchant; F. W. Jones, 5, Queen's Road, South Norwood, civil engineer. Registered without articles of association by W. Thompson, 15, Queen's Road, N.W.

Salisbury Electric Light and Supply Company, Limited (41,414).—This company was registered on the 21st inst., with a capital of £20,000, in £1 shares, to manufacture and supply electric current, light and power to the city of Salisbury. The subscribers (with one share each) are:—W. H. Gramshaw, Shorter's Court, E.C., gentleman; W. M. Hammick, J.P., The Close, Salisbury; W. Marlow, J.P., Milford Hall, Salisbury; D. J. K. Macdonald, The Close, Salisbury, solicitor; A. R. Malden, The Close, Salisbury, solicitor; A. R. Dawson, 53, Barnes Street, W., electrician; A. J. Dempsey, 11, Hornsey Rise Gardens, N. The number of directors is not to exceed six. Qualification, £250. Remuneration £50 per annum each. Registered by Slaughter & May, 18, Austin Friars, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Kerbey Bowen, Limited (40,310).—This company's statutory return has lately been filed. It shows that out of a nominal capital of £20,000 in £10 shares, 956 shares have been taken up, 800 of which have been agreed to be considered as paid. The total sum received in response to calls upon the remaining 156 shares is £1,500, and £60 is outstanding.

Waterhouse Electro-Meter Syndicate, Limited (37,936).—On June 13th, 1894, the statutory return of this company, made up to December 15th, 1893, was filed at Somerset House. Out of a nominal capital of £20,000 in 1,000 vendors' and 1,000 ordinary shares, all of £10 each, the whole of the vendors' and 260 ordinary shares have been taken up. A sum of £1,600 has been received, £1,000 is outstanding, and the vendors' shares were issued as fully paid.

BUSINESS NOTICES, &c.

Tumbler Switches.—Amongst the makers of switches a flutter of excitement has been caused by a notice issued on the first of the present month by the General Electric Company. This notice was to the effect that all makers and users of switches "in which the contact bar is pivoted at one end and actuated by a rocking handle, having the centre of oscillation above the bar, usually called link, tumbler or tumler switches, and which have a link, loose link, or heel-piece, or equivalent arrangement for the purpose of effecting a break action independently of the spring," are infringing their patent No. 3,664, of 1891, and rendering themselves liable to legal proceedings. Messrs. B. Verity & Sons, Messrs. Evered & Co., and Messrs. McGeoch and Co., have combined to set this intimation at defiance, and to give notice in return that if the threat of prosecution is not immediately made good, they will take steps to compel the withdrawal of the notice which, of course, has been detrimental to their business. In reply to this the solicitor to the General Electric Company states that with a view of testing the question of infringement they have decided to take proceedings upon a switch made by Messrs. McGeoch and Co., but, in the meantime, considerately delay the issue of process to give Messrs. McGeoch time to come to some arrangement in the way of paying a royalty. Messrs. McGeoch at once retorted that no delay need take place on this account, as they have no intention to submit; but, so far, the threatened writ has not been served. As to the heel-piece arrangement claimed by the General Electric Company, we are inclined to think that its use is more ancient than the date of the patent relied upon. It also seems to us that to attempt to harass the trade by a notice so general in its terms as that of June 1st, considering it is afterwards fined down by their solicitor as "not embracing link, tumbler and tumler switches generally, but such only as are an infringement of the patent," is not exactly a graceful or considerate action on the part of the General Electric Company.

Electric Lighting in Calcutta.—The *Indian Engineer* notices two instances in which electric light installations have been successfully carried out in Calcutta. One is at the Calcutta Flour Mills Company, Ltd., Narkaldanga, and consists of a vertical Hornsby engine, driving a Crompton Patent Compound Dynamo. There are 38 lamps of 32, 16 and 8 C.P. The wiring is carried out with Henley's A quality cable, having an insulation resistance of 2,000 megohms per mile. Two single pole cut-outs are placed at each point, where the section of the wiring is reduced, and each pendant is hung from a ceiling rose made on the high insulation principle and containing a safety cut-out. The contractors for the work were Messrs. Kilburn & Co.

The second installation has been carried out by The Oriental Telephone and Electric Company, Limited. This Company opened an electric light department in Calcutta some three months ago, and this is their first installation. It has been carried out at the Roller Flour Mills of Messrs. A. C. Mookerjee at Narkaldanga. The dynamo, a 60-light machine, is run from a counter-shaft, and is fixed on the first floor of the mill inside a small dust-proof room in which is also fixed the switchboard, testing instruments, &c. The lamps used are the Ediswan. The mill compound and offices are also lighted.

Edinburgh Electric Lighting.—The Electric Lighting Committee of the Town Council have agreed that in carrying out the electric lighting scheme for the city an additional main should be laid in Clyde Street and Elder Street, for supplying the light to business premises in that district. A report by Professor Kennedy stated that an additional forty-five lamps would be required for the proposed lighting of George Street, Charlotte Square, St. Andrew Square, and the cross streets leading up from Princes Street, and that these would cost from £20 to £22 per lamp.

Wood v. Elmore's French Patent Copper Depositing Company, Limited and another.—Notification is published in the *London Gazette* requiring the creditors of this Company (whose debts are otherwise than in respect of a debenture or mortgage) on or before the 23rd July to send their names and addresses, and the full particulars of their debts or claims, and the names and addresses of their Solicitors (if any), to J. H. H. Duncan, of 39, Coleman Street, E.C., the Liquidator of the Company; and, if so required, by notice in writing from the said Liquidator, are, by their Solicitors, to come in and prove their said debts or claims at the chambers of the Registrar, Companies Winding-up, Bankruptcy Buildings, Carey Street, W.C., at such time as shall be specified in such notice, or in default thereof they shall be excluded from the benefit of any distribution made before such debts are proved. Thursday, the 2nd day of August, 1894, at twelve o'clock at noon, at the said chambers, is appointed for hearing and adjudicating upon the said debts and claims.

Hampstead Electric Lighting and the County Council.—At the meeting of the London County Council on Wednesday there was considerable discussion regarding a report of the Finance Committee with respect to an application by the Hampstead Vestry for a loan of £25,000 on the instalment system, for electric lighting purposes, for a period of 50 years. The Committee recommended that the amount asked for be lent for a period of 25 years. They did so on the ground that in an undertaking of this kind a very large proportion of the initial cost was for short lived purposes, and in this respect it differed from a street improvement and many other works. From the nature of the undertaking large sums must be expended for renewals of boilers, dynamos, and mains at given periods in addition to ordinary maintenance repairs and small renewals, and it would be practically impossible for the vestry to pay these large sums out of the income of the year. The term of 25 years was the one adopted by the Local Government Board for electric lighting loans, and many provincial municipalities had borrowed on these terms for such schemes. Mr. Benn, M.P., and others urged that the Council should give the vestries the advantage of the provisions of the Money Act of last year, which provided that the term might be 42 years. Mr. H. Harben moved an amendment to this effect, and it was carried by a large majority.

The Electric Light Stopped by a Sparrow.—With regard to the failure of an electric lamp in a street at Bath, the inspector (Mr. Gatehouse) recently reported to a committee of the Town Council:—"This failure was due to a sparrow's nest having been built in the pipe which conveys the leads up the side of 10, Stall Street to lamp No. 5. The nest probably pressed the leads close to the side of the pipe, and the rain trickling down the pipe saturated the nest with moisture, forming a semi-connecting circuit between them. The leads (or conductors) are covered externally with prepared hemp and jute which absorbs moisture readily, and when they become saturated act in conjunction with the insulating material beneath them as a kind of condenser. When in this condition they are sufficiently close together, a small reduced spark may pass which ultimately destroys the insulation. This appears to have occurred in the present case, with the result that the nest took fire and the insulation broke down at this point." The chairman thought that the company should have taken precautions to prevent this. Another member of the committee said the company put up the pipe at the desire of the committee as the pavement was so narrow. He also mentioned that Mr. Gatehouse had kept the sparrow's nest as a curiosity.

Electric Lighting at Newcastle.—Messrs. Bainbridge and Co., of Market Street and Bigg Market, Newcastle-on-Tyne, are making some very extensive alterations, and considerably extending their premises, which necessitates a complete re-arrangement of their motive power plant and many additions thereto. This has been placed in the hands of Messrs. Thos. Becroft & Co., engineers, Leeds, and the contracts include one Lancashire boiler, 20 feet by 7 feet, to supply the steam to a new horizontal engine fitted with patent automatic trip expansion gear and giving off 75 effective H.P. This boiler also supplies the steam for heating the premises. There is also a compound Robey engine and boiler of 125 effective H.P., which is used for electric lighting. Exclusively the engines, boilers, &c., are being made by Messrs. Robey & Co., Lincoln. The whole of the electrical work is being carried out by Messrs. Scott & Mountain, Close Works, Newcastle, on a most extensive and elaborate scale. This portion of the work includes one of their latest dynamos, capable of running 1,000 16-C.P. lamps. There is also another dynamo for 300 16-C.P. lamps, electric motors, &c. These are for day service and are driven by the 75 H.P. engine.

Bournemouth Electric Lighting.—From the surveyor's report on the power at his disposal for electric lighting purposes, it appeared that a saving of £150 a year might be effected by the council lighting the winter gardens. The report is to be laid before Mr. E. M. Lacey, electrical engineer. The town clerk is to write the Electric Supply Company, asking if they would be prepared to make any (and what) reduction in the cost of lighting the winter gardens under an agreement for a term of years. The Local Government Board enquiry was held last week.

Llandudno and Electric Lighting.—The Llandudno Electric Supply Company, Limited, was registered on the 18th inst. The first directors are:—Dr. James Nicol, Dr. William R. Nicol, Messrs. R. Conway, J. Bellis, J. Smith (Craigside), W. Arnold, and William Ellis Jones. Mr. R. Bellis is the solicitor, and Mr. William Kingsland the electrical engineer to the company. It is a purely local directorate.

Electric Lighting and Ventilating of Ships.—Messrs. J. H. Holmes & Co. have lately carried out a large electric lighting and ventilating installation on the ss. *Petersburg*. The installation consists of the engines and dynamos, 300 16-C.P. lamps, and 6 electro motor fans. The engines are compound, each of 35 I.H.P. and fitted with automatic expansion governors. The dynamos, which are coupled direct to the engines, are Messrs. Holmes's new drum bar armature type. They are each capable of working the full load of 230 amps. at 100 volts, which is equivalent to 23,000 watts. The switchboard is arranged so that any group of lights or the fans can be switched on to either machine. In this way the load when heavy can be divided between the two machines. The fittings in the saloon, reception rooms, &c., are silver-plated and of handsome design. Those in the emigrant quarters are detachable so that in case of these holds being used for cargo, the fittings can be readily removed and a cover screwed in place, the wiring being so arranged that whatever other lights are on in the ship no wires carrying current are taken through these holds, thus eliminating all risk of fire in the event of rough usage in taking in cargo. The electromotor fans are said to be the largest which have yet been used for the ventilating of ships. They are fixed in the cossings of the ventilators, and consist of a special design of "Castle" motor with vertical spindle, which extends beyond the motor and on to which the fan is fixed. Messrs. Holmes also fitted electric bells throughout the ship.

Motor Construction.—Mr. H. T. Barnett, of the Battery and Motor Company, writes us as follows:—"You may be interested to hear that a result, as far as we know unparalleled, has recently been achieved by Messrs. Mavor & Coulson in motor construction. They have recently supplied us with a 500-watt Sayers motor for 500 revolutions per minute, which weighs under 2 cwt., and has an electrical efficiency of *over* 90 per cent. This is such an enormous advance on ordinary practice that I think it only due to my *confrères* who may be interested in motor design to state that I shall be pleased to put the machine at their disposal at any time for inspection or test." Without any intention of disparaging the reputation of Messrs. Mavor & Coulson as makers of first-class motors and dynamos, we must say that this statement regarding the results of this special motor's performance would require some confirmation. It is exceedingly difficult to measure the output in foot pounds per second on such a small motor, unless that measurement is made by a method above suspicion of errors. The efficiency of such small motors is generally arrived at by estimation, and that method, of course, is not so absolutely correct as to warrant the positive statement that the efficiency is 90 per cent.

Theatre Electric Lighting.—The electric light installation at the new Grand Theatre, Blackpool, will be carried out by Messrs. Sharp and Kent, the contract amounting to £1,605. Mr. R. Hammond is to superintend the arrangements.

An extensive installation of electric lighting is being made at the Bradford Theatre Royal. The power is supplied by two gas engines, each of 16 nominal horse-power. The fitting up of the machinery has been superintended by Mr. Taylor, the Bradford agent of the makers, Messrs Tangye. Two improved overtype dynamos, each easily capable of maintaining 350 16-candle power lamps at an approximate speed of 800 revolutions a minute, and working at 115 volts and 152 ampères, have been supplied by Messrs. Rosling & Mathews, of Bradford. These dynamos are specially fitted with heavy balanced slide rails. The general wiring and fitting of the place has been carried out by Messrs. Ullathorne and Hartley. Under their direction 454 16-candle-power incandescent lights have been provided for the auditorium.

Personal.—Mr. B. J. Diplock has been appointed Secretary of the Fowler-Waring Cables Company, Limited, vice Mr. D. Stephen, who resumes his duties as Accountant of the Company.

Mr. James Tiddy, late Manager of the Central and South American Telegraph Company, has been appointed Electrician in charge of the Testing Rooms of the Fowler-Waring Cables Company, Limited, at North Woolwich.

Mr. Albert G. Slater, of Messrs. J. Slater & Co., sails on the return voyage to Australia by R.M.S. *Himalaya*, leaving London the 6th July, after which date all correspondence should be addressed to the firm Messrs. John Slater & Co., Melbourne, Victoria, Australia.

Catalogues.—From Messrs. Hartmann & Braun, of Bockenheim, Frankfurt-a-Main, we have received a copy of their latest illustrated catalogue. The book contains numerous illustrations, and concise descriptions of their various manufactures, including direct-reading ohmmeters, wattmeters, and a great number of other measuring and general electrical apparatus. The whole of the matter is printed in German, but shortly the firm intend issuing an edition in English. On the whole the book is a very good production, and will be welcomed by the trade in Germany, as will also the English edition when published.

Electric Light at Leeds.—The Lamp Committee of the Leeds Corporation, last week, had before them a letter from the Yorkshire House-to-House Electricity Company, requesting the committee to consider the desirability of illuminating some of the streets in the centre of the city with the electric light. In order that there might be a fair trial, the company offered to supply the electric current for any number of arc lamps up to, say, 30 on the line of mains at 4d. per unit net. The committee felt, however, that the proposal was somewhat untimely. The letter was ordered to lie on the table.

Brighton Electric Lighting.—The Town Council passed the following minutes of the Electric Lighting Committee last week:—"The Town Clerk reported that the cost of providing and erecting the electric lamp pillars on the King's Road, including the lamps and canopies, had amounted to £3,466 2s. 4d., and that the amount of the loan which had been sanctioned for the work was £2,700, leaving a balance of £766 2s. 4d. to be provided. It was resolved to apply to the Local Government Board for sanction to borrow the amount. At a further meeting of the Committee held on June 7th, it was resolved to order a spare armature from Messrs. Siemens Bros. & Co., at £350."

Collier Audible Telephone Syndicate.—In the matter of this company, last week, on the hearing of the petition for its winding up, it was stated that arrangements had been entered into for the sale of the assets for a sum sufficient to provide for the costs of the liquidation, and 20s. in the £ to the creditors. The petition was directed to stand over for three weeks, on the understanding that the debt and costs due to the petitioners should be in the meanwhile paid.

English Electric Manufacturing Company.—This Company have in hand the Electric Lighting of the Refuse Destructors for the Corporation of Leicester. They have also just completed an installation of 350 lamps for Messrs. Leeson's new boot manufacturing premises at North Evington. The installation comprises a 40 H.P. high pressure engine driving a Castle dynamo. These contracts have been carried out under the supervision of their Mr. McInnes.

Change of Address.—Winfields, Limited, are removing their London sample room to No. 30, Snow Hill, E.C., directly opposite the old premises. Their London business will continue to be under the direction of Mr. Seymour Croneen.

The Edison & Swan United Electric Light Company, Limited, will, on August 27th next, remove from 100, Victoria Street, S.W., into their new premises, Ediswan Buildings, 36 & 37, Queen Street, Cannon Street, E.C.

New Firm.—Mr. G. E. Piggott who has for some years acted as representative for Mr. R. Applegarth in his electrical supply business carried on at 11, Queen Victoria Street, has resigned his connection with that gentleman and commenced operations in the wholesale and retail electrical supply trade at 110, Cannon Street, E.C. under the name of Piggott & Co.

Mr. J. D. Miller, M.I.E.E., has commenced business as a consulting and practical electrical engineer at 79, Commercial Street, Dundee.

Huddersfield Electric Lighting.—A quantity of cable is to be purchased from the India Rubber, Gutta Percha and Telegraph Works Company, and the engineer has been authorised to proceed to Silvertown to see the cable tested. A deputation of three, along with the electrical engineer, has been appointed to proceed to the City of London Electric Lighting Station to inspect, with a view to purchase, a 250 kilowatt alternator manufactured by the Brush Company.

Cardiff Electric Lighting.—The electric lighting contracts are progressing satisfactorily. Mr. W. H. Massey, the engineer to the Corporation, reports that the piping is completed with the exception of a few yards; 40 posts are erected, and eight only remain to be put up. All the dynamos have been delivered, but the erection of the engines is being delayed until the committee have appointed the fitters for whom they have advertised.

London Branch.—Messrs. Gabriel & Angenault, incandescent lamp makers of Paris, Madrid, and St. Petersburg, have opened a London branch at Connaught Mansions, Victoria Street, where a large stock of lamps will be kept. The fact that the firm have established a branch here instead of an agency, seems to indicate a desire to make their lamp as popular in England as abroad. They manufacture and deal solely in lamps.

Electric Light at Dewsbury.—Mr. Wm. Newsome, pianoforte manufacturer, of Ravensthorpe, is erecting new premises to serve as shops and offices. He has decided to have them lighted by electricity. The installation will consist of a 100-light dynamo, 4 arc lamps, and 72 16-C.P. incandescent lamps, and a 6 H.P. gas engine fixed on the premises. The order has been placed with Messrs. A. Hirst & Son.

Dundee Electric Lighting.—Mr. W. H. Brownlee having pointed out to the authorities that additional power will be required for the coming winter, Messrs. Urquhart & Small have been instructed to consider what should be done, and report on the matter, at the same time submitting an estimate of the cost.

Stage Lighting.—A great improvement has been effected at the Alhambra theatre. The stage has been fitted with an entirely new system of electric lighting, designed, arranged and carried out by Messrs. F. W. Henton & Co., of 26, King William Street, Strand, W.C.

Salisbury Electric Lighting.—Notice has been given of an application to the Board of Trade for a licence to enable the Electric Light and Supply Company, Limited, to produce and supply electricity for public and private purposes within the city.

Thorough Filtration of Water.—A simple apparatus that appears to realise the essentials of a sanitary filter has been invented by Mr. Knight, of 126, Charing Cross Road. The filtering medium is a film of asbestos so treated that when the water comes in contact with it, it pulps and forms so fine a medium that even micrococci cannot pass its surface. No impurities in suspension can pass through the film. They remain on its surface and nothing but pure water can go through. As the impurities collect on the surface the films gradually cease to act, clogging themselves up until at last no water whatever can pass through them, thus indicating to the user that a fresh film is required, but the films only cost 2d. each, and there is no complicated mechanism to remove or get out of order. The inventor has had the filters tested by Professor John Attfield, F.R.S., who, along with his son, Dr. D. Harvey Attfield, subjected them to exhaustive experiments. The results, briefly stated, show that visible and invisible suspended matters were absolutely removed

CONTRACTS OPEN AND CLOSED.

OPEN.

Bury.—July 2nd. The Electric Lighting Committee invite tenders for the erection of buildings in connection with central station, for the supply of electricity, including boiler-house, engine-house, accumulator-house, offices, &c., in accordance with the drawings and specifications prepared by Mr. J. Cartwright, M.Inst.C.E., borough engineer.

Edinburgh.—July 4th. The Corporation invite tenders for the following work in connection with the electric lighting of the city. Contract No. 6A: Supply of cast-iron road boxes; No. 10, supply of copper strip connectors, &c.; No. 11, supply of gun-metal grip boxes; No. 12, supply of cable connectors and cones. Copies of any of the specifications and drawings can be obtained from the resident electrical engineer, City Chambers, Edinburgh.

West Ham.—July 10th. For electric lighting at the Public Hall and free library, Barking Road, Canning Town, E., for the West Ham Town Council. Specification, form of tender, and further particulars may be obtained at the office of Mr. Lewis Angell, borough engineer, Town Hall, Stratford, E. Contractor will be required to enter into a bond with two sureties for the performance of the contract.

CLOSED.

Blackburn.—Tenders for the electric lighting of the Art Exhibition at Blackburn Free Library, in August, were considered last week, and the contract was let to Mr. H. Brennand.

Dundee.—The Gas Commission have agreed to contract with the Electrical Power Storage Company, Limited, for the maintenance of the batteries at the electric lighting station.

CITY NOTES.

Reuter's Telegram Company.

THE accounts for the year ended December 31st last show, after payment of current charges and deducting rebate on unexpired subscriptions, a debit balance of £2,766 19s. 4d. These figures do not include the advertisement branch. The report states that the heavy expenditure occasioned by the protracted civil war in Brazil, the troubles in Argentina, and the Matabele campaign, together with the losses sustained by the company owing to the fall in the Eastern exchanges, explains, in a great measure, the unfavourable results of the year's working. The directors regret that they are unable to declare a dividend, but are glad to be able to assure shareholders that the prospects for the current year are more favourable.

Admiral Sir J. C. D. Hay presided on Wednesday at the thirtieth ordinary general meeting of this company, at 24, Old Jewry.

In moving the adoption of the report, the CHAIRMAN said the shareholders would not be wholly unprepared for the statement he had to make, in view of the fact that during the whole of last year business continued in a state of the greatest depression. Like so many other businesses theirs had been adversely affected by the fall in silver. The subscriptions to their various news services in India, the Straits, and China being paid in silver, they had lost considerably

by the decline in the value of the rupee and dollar respectively. The loss due to this cause would be apparent when he reminded them that the difference between 1s. 6d. a rupee, the rate current when their contracts were entered into, and the actual rate, meant a loss in India and the Straits alone of about £2,000 per annum. The partial paralysis of trade arising from the same cause had reacted on their business in other departments. They would readily understand the large outlays rendered necessary by the protracted civil war in Brazil, the troubles in Argentina, and the Matabele campaign, not only in telegrams, but also in obtaining the information embodied in those telegrams. The accuracy and promptitude of their service regarding these matters had been generally recognised, and he was happy to be able to inform them that they enjoyed a larger measure of support from the Press than they had done at any previous period of their history. Their present arrangements in America were most satisfactory, and they were on the closest terms of alliance with the Associated Press.

Mr. Mark F. Napier, M.P., seconded the adoption of the report, which was carried.

The Electric and General Investment Company, Limited.

The fifth ordinary general meeting of this company was held on Tuesday at Winchester House, the only shareholders present being the directors and one of the auditors.

The Chairman (Mr. George Herring) said the profit and loss account showed a gross profit on the transactions of the year of £10,735, and after deducting all standing charges and the interim dividend already paid, there remained £7,369 available for distribution. The directors had made a provision of £8,000 for contingencies. The contingent liability amounted to about £35,000, but the directors were satisfied that the capital represented in the enterprises in which they had shares was well worth the money they had paid or might have to pay. The investments were taken at cost, and, even in these depressed times, the amount at which they stood could be easily realised.

The report was adopted, and a dividend of 40 per cent. for the half-year, making 25 per cent. for the year, was declared on the ordinary shares, and of £30 on each of the founders' shares. The warrants for the dividends on the ordinary and founders' shares have since been duly posted.

Hobart Electric Tramway Company, Limited.

The first annual general meeting of this company was held on Wednesday at College Hill Chambers, Cannon Street, E.C., under the presidency of Mr. D. J. Mackay.

The Chairman said: It is fitting that I should explain the cause of the protracted delay that has occurred in presenting our report, which you will see is for a period of about 21 months. The company was registered on March 4th, 1892, and our report is for the period to December 31st, 1893. You will recollect that under the contract with the original company it was provided that the vendor company should complete the lines to the satisfaction of this company, and hand over the same in time to enable Messrs. Siemens to commence the running by January 1st, 1893, and by the contract with Messrs. Siemens it was provided that the lines should be open for public traffic by that date. Instead of opening the line on January 1st, 1893, we were unable to do so, as the report shows, until September 21st following. Messrs. Siemens were unable to deliver a portion of the plant on account of a strike at the works of one of their contractors. After the plant had arrived in Tasmania, a difficulty arose with the Government, at the instance of the local telephone company, which alleged that our service would interfere with theirs. This difficulty proved to be serious, and involved protracted delay; but eventually it was amicably adjusted under an agreement by which our overhead wires were placed so as not to interfere with those of the telephone company. The suspension of operations was a matter of importance to us, as, meantime, our debenture interest had to be provided, and no revenue was being received. The service was opened on September 21st last, with the result that there was a considerable surplus after providing for the charges of maintenance. This surplus would doubtless have been larger but for the fact that the full service was not supplied at the start. It is only natural to expect troubles to arise at the commencement of running; but I am pleased to be in a position to announce that the service is now fairly well maintained, and that when we see our way to provide the additional sidings required, we shall be in a position to fulfil the expectations held out in the prospectus as to the extent of the service. In the report you will observe reference is made to the settlement with Messrs. Siemens of the amount due under their contract, and it is right I should allude to this matter. Messrs. Siemens, under their contract, were to hand over the line in working condition, with a full service, by December 31st, 1892; but the difficulties to which I have referred prevented this being done. We accordingly intimated a claim to Messrs. Siemens for loss of revenue for the nine months beyond the contract time. Messrs. Siemens put forward a counter-claim for loss occasioned them by our not providing them with way-leaves, as set out in the contract. After many meetings we adjusted a settlement on the basis of their being paid the balance due under their contract, but no extra charges, on condition that we departed from our claim for loss of revenue. Under Messrs. Siemens's contract they undertook to work the line for 12 months, from December 31st, 1892, at 4d. per car mile, receiving not less than £1,000 per month, including in same wages of conductors, drivers, and of all the necessary maintenance staff. By a subsequent arrangement with Messrs. Siemens, they undertook to work the line to March 31st last, on which date we took the maintenance into our own hands, having, with Messrs. Siemens's concurrence, entered into an agreement with their Mr. Parker to supervise the running. Under this arrangement we know that there will be a considerable annual saving. We consider ourselves fortunate in having secured the services of Mr. Parker, who acted as Messrs. Siemens's engineer during the period of construction. After explaining various items in the balance-sheet, the chairman continued: "I must refer to the fact that Sir Edward Braddon (the late chairman of the company), having returned to Hobart, has been elected to a seat on the committee there. This reduces the number of the London board, with a corresponding reduction in the fees payable to the London directors. We desire to carry on the business economically, but, at the same time, efficiently, and we hope that the arrangements we have now adjusted to this end will show results which you will consider satisfactory. The cars and electrical machinery have given entire satisfaction to our local committee and the public in Hobart, and your electric tramway is one of the many features of attraction in Tasmania. We, of course, regard the undertaking mainly from a commercial standpoint, but if to this be added, as in our case, the satisfaction of being the first to demonstrate in the Southern Hemisphere—at any rate, in the Australian colonies—the advantages of electric traction, the interest in our enterprise is naturally enhanced. Your directors trust when we next meet we shall be able to congratulate ourselves upon continued success, and that such success will have taken the tangible form of a dividend."

Mr. A. Mattei, LL.D., seconded the motion, which was carried.

The re-election of the retiring directors (Sir Edward N. C. Braddon and Mr. Charles Barclay) was moved by Dr. Mattei, and carried. Mr. Stewart proposed the reappointment of Messrs. G. N. Read, Son & Co. as the company's auditors, and this having been passed, the proceedings concluded.

The Swan United Electric Light Company, Limited.—An extraordinary general meeting of this company will be held at Cannon Street Hotel, on Tuesday, July 3rd, 1894, at 12 o'clock noon, for the purpose of considering and confirming, as a special resolution, the subjoined resolution, which was duly passed at the extraordinary general meeting held on June 14th, 1894, viz.:—"That the Swan United Electric Light Company, Limited, be wound up voluntarily, and that Henry Charles Gover, of 100, Victoria Street, in the City of Westminster, be, and he is hereby appointed, liquidator for the purpose of such winding up, and that the liquidator be, and he is hereby authorised to carry into effect upon the terms of a provisional agreement between the two companies, dated June 5th (subject to any modification), a sale of the company's undertaking to the Edison & Swan United Electric Light Company, Limited, for debenture stock of that company to be distributed among the members of this company."

Stock Exchange Notices.—The Stock Exchange Committee have appointed (1) a special settling day as under:—Wednesday, June 27th—County of London and Brush Provincial Electric Lighting Company, Limited, 20,000 ordinary shares, Nos. 1 to 20,000; Waterloo and City Railway Company, shares Nos. 1 to 54,000. And (2) ordered the undermentioned securities to be quoted in the Official List:—Crompton & Co., Limited, further issue of 8,180 7 per cent. cumulative preference shares, Nos. 20,001 to 28,180; Waterloo and City Railway Company, shares Nos. 1 to 54,000.

Oriental Telephone and Electric Company, Limited.—In compliance with the 39th section of the Companies' Act of 1867, the first ordinary general meeting of the above company will be held on Wednesday, July 4th, at 1 o'clock p.m., at Winchester House, Old Broad Street, London, E.C.

Salt Lake and Ogden Gas and Electric Light.—The Gas, Water, and General Investment Trust notify that the coupons of the company's first mortgage 6 per cent. bonds, due July 1st next, will be paid at the National Provincial Bank of England, Bishopsgate Street, on and after July 2nd.

City of London Electric Lighting Company, Limited.—The directors have declared an interim dividend on the preference shares at the rate of 6 per cent. per annum for the six months ending the 30th inst., the dividend to be payable on and after the 19th proximo.

Eastern Extension, Australasia, and China Telegraph Company.—The directors of this company have declared an interim dividend for the quarter ending March 31st of 2s. 6d. per share, free of income-tax.

India-Rubber, Gutta-Percha, and Telegraph Works Company.—An interim dividend of 5 per cent. is proposed by the board.

TRAFFIC RECEIPTS.

The City and South London Railway Company. The receipts for the week ending June 24th, 1894, amounted to £863; week ending June 25th, 1893, £765; increase, £98; total receipts for half-year, 1894, £22,616; corresponding period, 1893, £21,799; increase, £817.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending June 22nd, after deducting 17 per cent. of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £2,401.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1891.	1892.	1893.	Closing Quotation, June 20th.	Closing Quotation, June 27th.	Business done during week ended June 27th, 1894. Highest.	Lowest.
184,500£	African Direct Teleg., Ltd., 4 % Deb.	100	...	...	...	102 —105	102 —105	104½	...
1,134,640£	Anglo-American Teleg., Ltd.	Stock	£2 12s.	£2 15s.	£2 11s.	40 — 42	37 — 40	39½	39
2,932,680£	Do. do. 6 % Pref.	Stock	£5 5s	£5 10s.	£5 2s.	76 — 77	70 — 72	76¾	69¼
2,932,680£	Do. do. Defd.	Stock	...	...	...	7 — 7½	6¼— 6¾	6⅞	6¼
130,000	Brazilian Submarine Teleg., Ltd.	10	8 % §	6¼% §	6½% §	12¼— 12¾	12 — 12½	12⅝	12¼
18,700£	Do. do. 5 % Bonds	100	...	...	...	101 —104	101 —104	...	...
75,000£	Do. do. 5 %, repayable June 1906	100	...	...	...	109 —113	109 —113	...	...
44,000	Chili Telep., Ltd., Nos. 1 to 40,000	5	... §	10%‖ §	... §	1½— 2½	1½— 2½	...	...
10,000,000$	Commercial Cable Co.	$100	7 %	7 %	7 %	139 —143 xd	139 —143	...	...
224,850	Consolidated Telep. Const. and Main., Ltd.	10/-	3½% §	2 % §	2 % §	1/16 — 3/16 xd	1/16 — 3/16	...	...
16,000	Cuba Teleg., Ltd.	10	8 %	8 %	8 %	12 — 13	12 — 13	...	...
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	18½— 19½	18½— 19½	...	...
12,931	Direct Spanish Teleg., Ltd., £4 paid	5	4½%	4 %	4 %	4 — 4½	4 — 4½	...	...
6,000	Do. do. 10 % Pref.	5	10 %	10 %	10 %	9 — 9½	9 — 9½	9¼	...
60,710	Direct United States Cable, Ltd., 1877	20	3½% §	3½% §	...	9¼— 9⅜	8 — 9	9 1/16	9
400,000	Eastern Teleg., Ltd., Nos. 1 to 400,000	10	6½% §	6½% §	...	15 — 15¼	15 — 15¼	15 3/16	15
70,000	Do. 6 % Pref.	10	6 % §	6 % §	...	15¾— 16¼	15¾— 16¼	16⅛	15¾
105,900£	Do. 5 % Debs., repay. August, 1899	100	...	...	...	107 —110	107 —110	...	...
1,294,100£	Do. 4 % Mort. Deb.	Stock	...	...	...	113 —116	113 —116	115	114
250,000	Eastern Extension, Australasia and China Teleg., Ltd. ...	10	7 %	7 %	7 %	15⅝— 15⅞	15⅛— 15⅜	15⅝	15¼
62,700£	Do. 5 % (Aus. Gov. Sub.), Deb., 1900, red. ann. drgs. reg. 1 to 1,049, 3,976 to 4,326	100	...	...	...	105 —108	105 —108	107½	...
222,800£	Do. do. Bearer, 1,050—3,975 and 4,327—6,400	100	...	...	...	105 —108	105 —108	...	...
320,000£	Do. 4 % Deb. Stock	Stock	...	...	...	114 —118	114 —118	...	...
95,100£	Eastern and South African Teleg., Ltd., 5 % Mort. Deb. 1900 redeem. ann. drgs., Reg. Nos. 1 to 2,343	100	...	...	...	105 —108	105 —108	...	...
129,100£	Do. do. do. to bearer, 2,344 to 5,500	...	...	...	...	105 —108	105 —108	...	...
300,000£	Do. 4 % Mort. Debs. Nos. 1 to 2,016, red. 1909	100	...	...	...	105 —108	105 —108	...	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1 to 8,000	25	...	...	...	107 —110%	107 —110%	...	...
180,227	Globe Telegraph and Trust, Ltd.	10	5¼% §	4⅞% §	4⅝% §	8⅝— 8⅞	8½— 8⅝	8 1/16	8 1/16
180,042	Do. do. 6 % Pref.	10	6 % §	6 % §	6 % §	15½— 15⅝	15 — 15½	15½	15
150,000	Great Northern Teleg. Company of Copenhagen	10	8⅖% §	8⅖% §	8⅖%	21 — 21½	21 — 21½	...	...
200,000£	Do. do. do. 5 % Debs.	100	...	...	...	105 —108	105 —108	107½	...
17,000	Indo-European Teleg., Ltd.	25	10 %	10 %	10 %	43 — 45	43 — 45	...	...
37,548	London Platino-Brazilian Teleg., Ltd.	10	...	...	...	5 — 7	5 — 7	...	...
100,000£	Do. do. 6 % Debs.	100	...	...	...	107 —110	107 —110	...	...
15,000	Monte Video Teleph. Co., Ord., 1 to 15,000	5	...	...	...	½— 1½	½— 1½	...	...
28,000	Do. do. 6 % Pref., 1 to 28,000	5	...	...	...	1 — 2	1 — 2	...	...
484,597	National Teleph., Ltd., 1 to 438,984	5	6 % §	5 % §	...	5 — 5¼	4⅞— 5⅛	5⅛	4 1/16
15,000	Do. 6 % Cum. 1st Pref.	10	...	...	...	15 — 16	15 — 16	...	...
15,000	Do. 6 % Cum. 2nd Pref.	10	...	...	...	14½— 15½	14½— 15½	...	...
119,234	Do. 5 % Non-cum. 3rd Pref., 1 to 90,950	5	...	...	...	5⅛— 5⅜	5⅛— 5⅜	5¾	...
925,017£	Do. 4½ % Deb. Stock Prov. Certs. ...	...	...	...	...	112 —115	112 —115	115	...
48,800	New Teleph., Ltd., 25,901 to 74,700; £4 paid	10	...	...	...	... ...	... ...	...	...
171,504	Oriental Teleph. & Elec., Ltd., Nos. 1 to 171,504, fully paid	1	...	...	...	⅛— ⅜	⅛— ⅜	...	...
100,000£	Pacific and European Tel., Ltd., 4 % Guar. Debs, 1 to 1,000	100	...	...	...	103 —106	103 —106	...	...
11,839	Reuter's Ltd.	8	5 %	5 %	...	5 — 6	5 — 6	6	5
3,381	Submarine Cables Trust	Cert	...	...	...	110 —115	108 —113	111	...
58,000	United River Plate Teleph., Ltd.	5	...	...	...	1½— 2	1½— 2	...	...
146,370£	Do. do. 5 % Debs.	Stock	...	...	...	90 —100	90 —100	...	...
15,609	West African Teleg., Ltd., 7,501 to 23,109	10	4 %	..	...	3 — 5	3 — 5	...	...
249,900£	Do. do. do. 5 % Debs.	100	...	...	...	102 —105	102 —105	103½	102½
30,000	West Coast of America Teleg., Ltd.	10	...	...	...	2½— 3	2½— 3	...	...
150,000£	Do. do. do. 8 % Debs., repay. 1902	100	...	...	...	100 —105	100 —105	...	...
64,242	Western and Brazilian Teleg., Ltd.	15	4 %	2½%	5 %	6¾— 7¼	6½— 7	...	...
33,129	Do. do. do. 5 % Cum. Pref. ...	7½	...	...	...	6 — 6½	5⅞— 6¼	6	...
33,129	Do. do. do. 5 % Def.	7½	3 %	...	...	2 — 2½	2 — 2½	2	...
178,200£	Do. do. do. 6 % Debs. "A,"1910 ...	100	...	...	...	107 —110	107 —110	...	...
222,700£	Do. 6 % Mort. Debs., series "B," red. Feb. 1910	100	...	...	...	107 —110	107 —110	...	...
88,321	West India and Panama Teleg., Ltd.	10	¼%	¼%	⅜%	1⅛— 1⅜	1⅛— 1⅜	...	...
34,563	Do. do. do. 6 % 1st Pref. ...	10	...	...	...	10 — 10½	10 — 10½	10⅝	10
4,669	Do. do. do. 6 % 2nd Pref. ...	10	...	...	..	9 — 10	9 — 10	...	...
80,000£	Do. do. 5 % Debs. (1917) No. 1 to 1,000	100	...	...	...	109 —112	109 —112	...	...
$1,214,000	Western Union of U. S. Teleg., 7 % 1st Mort. Bonds ...	$1000	...	...	...	110 —115	110 —115	...	...
169,000£	Do. do. 6 % Ster. Bonds.	100	...	...	...	100 —104	100 —104	...	...

ELECTRICITY SUPPLY COMPANIES.

20,510	Charing Cross and Strand Electy. Supply, 1 to 6, 215 to 718, and 10,001 to 30,000	5	...	5 %	4¼%	4½— 5½	4½— 5½	...	...
40,000	City of London Elec. Lightg. Co., Ltd., Ord. 40,000—180,000	10	...	...	...	12 — 13	12½— 13½	...	...
20,000	Do. do. 6 % Cum. Pref., 1 to 20,000	10	...	6 %	6 %	13½— 14	13½— 14½	14	13⅞
100,000	Do. 5 % Deb. Stock, Scrip. (iss. at £115) £75 paid	...	...	...	...	87 — 90	87 — 90	89⅜	...
19,900	*Electy. Supply Co. of Spain, 101 to 20,000...	5	...	...	...	... ...	... ...	...	...
45,000	†Liverpool Electric Supply, £4 10s. paid	5	4½%	5 %	5 %	6⅜— 6½	6⅜— 6½	...	...
49,900	*Metropolitan Electric Supply, Ltd., 6,101 to 50,000 ...	10	1 %	2 %	2½%	8½— 9	8½— 9	8¾	...
100,000£	Do. 5% Deb., 1 to 10,000 in bonds of £10, £20, £40	...	...	...	...	107 —110	108 — 111	111	...
6,452	Notting Hill Electric Lightg. Co., Ltd.	10	...	...	...	4½— 5½	4½— 5½	...	...
19,980	St. James's & Pall Mall Elec. Light Co., Ltd., Ord., 101-18,780	5	8½%	7½%	4½%	7 — 7½	7 — 7½	7¾	...
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	8¼— 8¾	8¼— 8¾	8⅜	...
59,900	*Westminster Electric Supply Corp., Ord., 101 to 60,000 ...	5	...	3½%	4 %	6½— 6¾	6½— 6¾	6½	6⅜

* Subject to Founder's Shares. † Quotations on Liverpool Stock Exchange.

‡ Unless otherwise stated all shares are fully paid. ‖ Dividends paid in deferred share warrants, profits being used as capital.

Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL, COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1891.	1892.	1893.	Closing Quotation, June 20th.	Closing Quotation, June 27th.	Business done during week ended June 27th, 1894. Highest.	Lowest.
90,000	Brush Elecl. Enging. Co., Ord., 1 to 90,000...	3	...	6 % §	6 % §	2⅜— 3	2⅜— 3	3	2⅞
90,000	Do. do. Non-cum. 6 % Pref., 1 to 90,000	2	...	6 % §	6 % §	2½— 2⅝	2½— 2⅝	2 5/16	...
125,000/	Do. do. 4½ % Deb.	Stock	...	...	...	109 —112	109 —112	...	...
630,000/	City and South London Railway	Stock	...	⅝%	⅝%	36 — 38	36 — 38	...	...
20,000	Crompton & Co., Ltd., 7 % Cum. Pref. Shares, 1 to 20,000	5	7 % §	7 % §	7 % §	2¾— 3¼	2¾— 3¼	...	...
50,000/	Do. do. 5 % 1st Mort. Debs., 1—400 of £100, and "A" 1—200 of £50 each	...	...	...	...	95 —100	95 —100	...	...
120,000	Electric Construction, Ltd., 1 to 120,000	2	...	...	...	¼— ⅜	¼— ⅜	...	...
12,845	Do. do. 7 % Cum. Pref., 1 to 12,845 ...	2	...	...	...	1¼— 1⅜	1¼— 1⅜	...	...
100,000	Elmore's French Patent Cop. Deposg., Ltd., 1 to 66,750 ...	2	*nil*	*nil*	*nil*	⅛— ⅜	⅛— ⅜	...	...
91,195	Elmore's Patent Cop. Deposg., Ltd., 1 to 70,000	2	*nil* ¶	*nil*	*nil*	1⅛— 1⅜	1 — 1¼	1 1/16	1
67,385	Elmore's Wire Mfg., Ltd., 1 to 67,385, issued at 1 pm. ...	2	*nil*	*nil*	*nil*	⅛— 1⅛	⅛— 1⅛	1 1/16	1
20,000	Fowler-Waring Cables, Nos. 301 to 20,300	5	*nil* §	*nil* §	*nil* §	½— 1⅛	½— 1⅛	9/16	½
9,600/	Greenwood & Batley, Ltd., 7 % Cum. Pref., 1 to 9,600 ...	10	7 %	...	...	6½— 7½	6½— 7½	...	...
6,837	Henley's (W. T.) Telegraph Works, Ltd., Ord.	10	5 %	5 %	5 %	6½— 7½	6½— 7½	...	...
50,000	India-Rubber, Gutta Percha and Teleg. Works, Ltd. ...	10	12½%	12½%	12½%	23½— 24½	23½— 24½	24⅛	23⅝
200,000	Do. do. do. 4½ % Deb., 1896	100	...	...	...	103 —105	103 —105	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	...	...	1 %	8 7/16— 8 9/16	8 3/16— 8 5/16	8¾	...
6,295	† Do. do. Pref., £8 paid	10	...	...	...	12⅜— 13½	12⅜— 13½	...	...
78,949	Swan United Electric Light, Ltd., £3½ paid	5	11 % §	10 % §	7½% §	2 — 2½	2 — 2½	2⅜	...
37,350	Telegraph Constn. and Maintce., Ltd.	12	20 %	15 %	20 %	39 — 41	40 — 42	41¼	40¼
150,000/	Do. do. do. 5 % Bonds, red. 1894	100	...	...	...	104 —107	104—107	...	...

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ Last dividend paid was 50 % for 1890.

Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

Crompton & Co.—The dividends paid on the ordinary shares (which have not a Stock Exchange quotation), are as follows: 1892—0 % §; 1891—7 % §; 1890—8 % §.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Birmingham Electric Supply Company, Ordinary of £5 (fully paid), 5¼—5⅜.

Electric Construction Corporation, 6 % Debentures, 87—92.

Electric and General Investment, shares of £5 (£1 paid), 1¾—2¼.

Electricity Supply Corporation, Ordinary of £5, 5—5¼.

House-to-House Company (£5 paid), 1—1½.

Do. do. 7 % Preference, of £5, 5¼—5½.

Do. do. 6 % Debentures of £100, 101—103.

Kensington and Knightsbridge Electric Lighting Company, Limited, Ordinary Shares £5 (fully paid) 4¾—5¼; 1st Preference Cumulative 6 %, £5 (fully paid), 6¼—6⅜.

Liverpool Electric Supply, £5 (fully paid), 6½—6⅝.

Do. do. £3 10s. paid, 4½—4⅝.

London Electric Supply Corporation, £5 Ordinary, ⅞—1¼.

Queen Anne's Mansions Lighting and Heating Company, 6 % £100 Debentures, 101—103.

Yorkshire House-to-House Electricity Company, £5 Ordinary Shares (£4 10s. paid), 4¼—4⅜.

Bank rate of discount, 2 per cent. (February 22nd, 1894).

CENTRAL STATIONS FOR ELECTRIC ENERGY IN GERMANY.*

"L'Industrie Electrique" has paid especial attention to the study of central stations for electric energy, and has already published statistics for all countries where such publication has been practicable. We cite the successive editions of plans of central stations in France, the tables of the central stations in Switzerland, the synoptic table of the electric sectors at Paris.

It remains for us to give a general study of the central stations of Germany and the adjoining countries. Our work commenced long ago, and was being slowly pursued when recently the *Elektrotechnische Zeitschrift* published two very interesting studies which enable us to give at once statistical tables of the central stations.

The first is due to the Statistical Commission of the *Elektrotechnischer Verein*, of Berlin, presented to that Society by Herr Uppenborn, April 24th, 1894. The second is due to the Statistical Commission of the Free Association of Representatives of Central Stations, reported by Herr Gusinde, and published in the *Elektrotechnische Zeitschrift*, May 24th, 1894. These two studies have some points in common, but differ in others. We have preferred to study each of them separately, rather than amalgamate them into a single memoir.

In his communication, Herr Uppenborn shows at first the difficulties which he encountered in obtaining information, especially after the establishment of the Free Association of Representatives of Central Stations. He gives only little information on the works, and on the distributions themselves. He divides the central stations into five groups:—(1) Works with continuous currents without accumulators; (2) works with accumulators; (3) works with alternating currents and transformers without secondary circuits for distribution; (4) works with alternating currents with transformers and secondary circuits for distribution; (5) works with polyphase currents.

To the first group belong the works of Berlin, Elberfeld, Neuhadersleben, and Traben-Trarbach; to the second, those of Altona Barmen, Darmstadt, Düsseldorff, Gablonz, the Hague, Hagen, Hamburg, Mulhouse, Stettin, Stockholm, Vienna (Mariahilf); to the third, the works of Innspruck and Vienna; to the fourth, those of Burghausen and Fürstenfeldbruck; and to the fifth those of Lauffen-Heilbronn. Herr Uppenborn has especially sought to give information on the utilisation of the electric energy. We reproduce the table published for this purpose, which is our table No. 1. The towns have been classified according to population. We do not insist on all the details included in this table, considering that the figures speak for themselves, though we append some remarks. The selling price of electric energy is, at least, 0·09 franc per hectowatt-hour in the towns of Barmen, Elberfeld, Mulhouse, and Stettin. At Dusseldorff and Trarbach the tariff is 0·1125 franc per hectowatt-hour. We must especially mention Triberg, where the price per hectowatt-hour is only 0·639 franc. Very variable discounts are allowed in each town. As for the sale of electric energy for motors, the prices are also very different. In some towns the tariffs are the same as for light, whilst in others special prices have been established. The price is highest at Gummersbach, where the hectowatt-hour is sold at 0·066 franc. Then come Mulhouse (0·036 franc), Berlin (0·025 franc), and Triberg (0·0125 franc). At Lauffen, the hectowatt-hour sells at from 0·0375 to 0·022 franc; at Altona, discounts of from 10 to 45 per cent. are allowed for installations of from 1 to 20 H.P., and of 10 to 30 per cent. for yearly times of 1,000 to 3,000 hours. It must likewise be remarked that the highest consumptions of electric energy for motive power occur in the smallest towns—24·1 per cent. of the total consumption at Fürstenfeld-Bruck, 16·6 at Gablonz, 16·1 at Lauffen, and 8·6 at Berlin.

The study of the Statistical Commission of the Free

* *L'Industrie Electrique.*

I.—Table of the Statistical Commission of Central Stations, from the "Elektrotechnical Verein," of Berlin.

Central stations.	Population in thousands of inhabitants.	Power installed.		Length of front of houses in kilometres.	Power installed per metre run of front in hectowatts.	Percentage consumption of the total.									Total energy consumed yearly.		Maximum power consumed in kilowatts.	Proportion of maximum power consumed to maximum installed.	Utilisation in hours per hectowatt.		
		In kilowatts.	Per 1,000 inhabitants in kilowatts.			Houses and hotels.	Offices.	Warehouses.	Restaurants and coffee houses.	Theatres and music halls.	Workshops and factories.	Public buildings.	Streets.	Motors.	In kilowatts.	Per 1,000 inhabitants in kilowatts.			Installed.	Utilised.	Greatest daily power.
I.—Towns of more than 250,000 Inhabitants.																					
Berlin	1,700	9871·6	5·81	126·0	0·782	19·9	18·4	30·6	9·2	9·4	4·0	...	...	8·6	6,684,500	3,900	4,580	46·4	1·9	4·0	...
Vienna { Mariahilf ...	1,365	809·4	2·25	38·36	0·211	16·3	7·3	34·0	5·0	22·9	7·6	...	...	6·8	421,071	980	487	60·2	1·4	2·4	4·8
Vienna { Intern. E. G....	...	2258·9	...	20·0·0	0·113	38·7	16·1	22·6	11·9	8·0	1·3	...	...	1·3	911,466	...	894	39·6	1·1	2·9	7·3
Hamburg	650	700·8	1·08	10·0	0·701	17·7	19·3	37·0	9·4	10·8	1·3	...	4·1	0·5	511,900	790	430	61·3	2·0	3·3	8·9
Stockholm	250	207·4	0·83	14·2	0·146	...	...	...	...	...	...	...	...	...	52,812	...	113	43·4	0·7	1·3	8·9
II.—Towns of 75,000 to 250,000 Inhabitants.																					
S'Gravenhage	160	303·1	1·89	9·0	0·337	14·1	14·1	38·5	16·3	15·7	0·9	...	...	0·3	341,612	2,130	215	71·7	3·1	4·3	8·4
Düsseldorf	155	874·1	5·64	21·5	0·407	21·9	3·8	22·1	4·6	14·7	1·9	27·9	...	0·3	325,247	2,100	314	36·0	1·0	2·3	6·6
Altona	143	214·1	1·50	22·9	0·093	5·0	13·2	35·0	17·0	2·0	11·5	...	15·0	1·3	170,839	1,190	125	58·8	2·2	3·7	6·3
Elberfeld	132	602·3	4·56	19·0	0·317	12·5	22·7	45·1	4·3	5·8	8·9	...	...	0·7	335,387	2,540	408	67·8	1·5	2·2	6·7
Barmen	125	401·5	3·21	18·8	0·214	21·7	8·8	18·7	7·7	29·0	7·9	...	1·1	2·0	122,025	970	136	33·4	0·8	2·6	6·5
Stettin	120	512·7	4·27	9·5	0·540	18·5	24·6	31·8	6·6	8·8	6·2	...	...	3·5	238,299	2,000	281	55·0	1·3	2·3	...
Mulhouse	77	483·9	6·28	15·5	0·312	37·2	10·4	18·2	5·1	8·5	14·5	2·8	...	...	155,732	2,000	190	39·3	0·9	2·2	5·2
III.—Towns of from 10,000 to 75,000 Inhabitants.																					
Darmstadt	56·4	437·5	7·75	10·25	0·427	16·2	7·7	22·7	3·4	38·3	8·1	3·2	...	0·5	156,415	2,770	213·4	52·9	1·0	1·9	7·2
Ziskow	46	107·6	2·33	6·0	0·179	15·6	10·4	15·6	31·2	1·5	3·5	...	...	...	144,000	3,100	42·0	27·0	...	...	...
Hagen	37	84·0	2·27	...	...	62·1	1·9	32·5	...	...	3·3	...	...	...	32,717	880	40·8	48·6	1·1	2·2	6·4
Lauffen	30	148·0	4·93	12·0	0·123	24·3	8·8	25·3	8·0	...	11·9	1·5	4·1	16·1	...	...	110·0	74·2	1·5	2·0	...
Inspruck	24	160·0	6·68	4·0	0·401	24·3	3·0	36·8	13·2	1·5	1·1	12·1	...	8·1	...	...	140·0	87·3	...	...	...
Gablonz	16·5	178·0	10·78	...	...	24·0	22·6	6·2	8·2	6·2	4·6	9·8	1·8	16·6	104,168	6,300	84·0	47·2	1·6	3·4	8·6
Gummersbach	10	122·0	12·24	...	...	36·2	7·8	4·8	7·6	2·7	38·9	...	...	2·0	38,862	3,890	51·0	41·7	0·9	2·1	6·7
IV.—Towns of less than 10,000 Inhabitants.																					
Neuhaldensleben ...	8·7	99·9	10·87	...	...	22·9	3·4	22·8	9·6	...	31·1	3·3	...	6·8	...	...	5·7	57·1	...	...	...
Fürstenfeld-Bruck ...	3·2	93·3	29·1	7·0	0·133	32·1	1·8	5·9	11·4	2·1	11·8	...	10·7	24·1	...	...	55·2	59·2	...	...	11·4
Traben-Trarbach ...	3·0	70·0	23·3	6·0	0·117	22·7	7·1	3·6	3·6	...	48·2	...	8·7	6·1	46,800	15,600	33·4	47·7	1·8	3·8	6·8
Gastein	3·0	60·5	20·1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Burghausen	2·9	40·0	13·8	5·0	0·08	21·2	...	6·2	6·2	6·2	6·2	37·5	13·6	...	15,000	5,170	...	65·0	1·0	1·6	...
Triberg	2·5	111·2	44·5	1·5	0·741	41·3	2·5	9·9	4·9	...	22·3	...	7·6	11·6	...	...	...	...	...	...	...

II.—Tables of the Statistical Commission of the Free Association of Representatives of Central Stations.

A.—*General and Technical Information concerning the Installations.*

Central Stations.	Population.	Set in action.	System of distribution.	Boilers. System.	Boilers. Pressure in kg : cm.	Boilers. Heating surface in m².	Steam engines.	Dynamos.	Accumulators. No. of cells.	Accumulators. Capacity in ampère-hours.	Difference of potential in volts. Works.	Difference of potential in volts. Consumers.	Loss in volts. Feeders.	Loss in volts. Circuits of distribution.	Leads.	Carrying power of the leads in kw.
1. Aix-la-Chapelle	103,500	Jan. 1, 1893.	Continuous currents with accumulators, three wires.	3 Lancashire ...	12	140	Two engines, three cylinders, 350 H.P.	2 multipolars, ring, shunt of 240 kw.	140	3,220	245	2.103	2.20	2.1,5	Cables in lead, armoured, buried.	500
2. Altona... ...	143,249	Feb. 20, 1892	... ...	2 Lancashire ...	12	212	2 vertical engines, triple-expansion, 350 H.P.	... ...	2.140	7,560	250	2.108	2.20	2.2	... ...	800
3. Barmen ...	125,000	Dec. 19, 1888	... ...	3 Galloway tubes	8	93	Two compounds without condensation, 100 H.P. 1 compound without condensation, 160 H.P.	4 multipolars, ring, shunt of 30 kw. 2 multipolars, ring, shunt of 48 kw.	130	3,780	230—244	2.110	2. 4·3 2.10	2.1	... ...	308
4. Bremen ...	135,000	Autumn, 1893	Sub-station with accumulators charged by central station, low voltage, 3 wires	3 with circulation	12	175	3 verticals, triple-expansion, 240 H.P.	3 dynamos, with inner poles, 160 kw.	4.138	5,600	310	2.110	2.15	2.2	... ...	1,000
5. Breslau ...	355,186	June 30, 1891	Continuous currents, accumulators, three wires.	3 Heine	10	173	3 compounds, 250 H.P.	6 dynamos, with inner poles, 81·25 kw.	3.140	6,430	230—360	2.110	2.14	2.1·5	... ...	785·4
6. Cassel	75,000	July 1, 1891	Central station with simple alternating currents at 7 kilometres; sub-station with motors driving continuous current dynamos.	1 tubular ...	7	80	4 Jonval turbines, total 180 H.P. 1 locomotive, 100 H.P.	Central station : 2 simple alternators of 66 kw. Sub-station: two motors, coupled, with 4 dynamos, continuous, of 24·8 kw.	2.130	3,120	220—250	2.107	2.15	2.1·5	Simple cables buried.	200
7. Darmstadt ...	56,400	August, 1888	Continuous currents three-wire with accumulators.	2 Cornwall ... 1 tubular ...	8 8	82 111	3 compounds, 75 H.P. 1 compound, 60 H.P. 1 compound, 150 H.P.	5 dynamos, with inner poles, 65·6 kw. 2 dynamos, with inner poles, 25 kw.	132	1,100	218—230	2.108	2. 5	2.1·5	Simple cables buried.	330
8. Dessau ...	40,000	Oct. 1, 1886	Continuous currents two-wire with accumulators.	Gas motors ...	...	...	1 Otto gas engine, 120 H.P. 1 Otto gas engine, 60 H.P.	1 multipolar dynamo, ring, of 80 kw. 1 multipolar dynamo, drum, of 40 kw.	63	1,700	115	106	8·5	1·5	Cables in lead, armoured, buried.	200
9. Düsseldorf ...	155,411	Sept. 1, 1891	Central station feeding (at 3 km. at 2 wires) three sub-stations of accumulators in parallel; secondary distribution with three wires.	4 tubulars ...	9	150	2 compound tandems, condensation, 300 H.P.	2 multipolars, shunt, of 200 kw.	2.140 in each of three sub-stations.	10,920	290	2.107	2.5—18	2.1·5	Cables in lead, armoured, buried.	1,250
10. Elberfeld ...	132,000	Nov. 15, 1887	Continuous currents without accumulators, three wires.	6 Lancashire ...	8	738	6 compound condensing, 200 H.P.	8 dynamos, drum, 2 poles, shunt, of 46·8 kw. 4 dynamos, inner poles, of 103 kw.	...	...	220—232	2.110	2.6	2.1·5	Concentric cables, armoured, buried.	715

A.—*General and Technical Information concerning the Installations—(continued).*

Central Station.	Population.	Set in action.	System of distribution.	Boilers. System.	Boilers. Pressure in kg : cm.	Boilers. Heating surface in m².	Steam engines.	Dynamos.	Accumulators. No. of elements.	Accumulators. Capacity in ampère-hours.	Difference of potential in volts. Works.	Difference of potential in volts. Consumers.	Loss in volts. Feeders.	Loss in volts. Circuits of distribution.	Leads.	Carrying power of the leads in kw.
11. Gera	40,000	Jan. 1, 1892	Continuous currents with accumulators, 3 wires, neutral wire of bare copper	3 tubulars ...	10	151	3 compound, 150 H.P.	6 dynamos, multipolars, inner poles, excitation by accumulators of 550 kw.	132	2,130	243	2.110	2.10	2.1·5	Cables in lead, armoured, buried.	153
12. Greifenhagen...	7,000	June 1, 1892	Continuous currents with accumulators, two wires, aerial.	1 tubular ...	7	30	1 machine, 25 H.P.	1 dynamo, drum, 2 poles, shunt, of 16·2 kw.	65	432	112—120	110	12	2	Cables of bare copper on a porcelain insulator.	33
13. Gummersbach..	10,000	April, 1890	Continuous currents with accumulators, 2 wires by battery at works, two batteries at sub-stations in parallel.	Locomotive ...	...	...	2 locomotives, 40 H.P.	2 dynamos, shunt, of 21 kw.	264	1,244	150—170	150	...	7	Cables of bare copper, aerial.	89
14. Hagen... ...	37,000	Autumn, 1890	Continuous currents with accumulators, 2 wires, 150 volts.	Gas motors ...	...	...	2 gas motors, 8 H.P.	2 dynamos, shunt, of 36 kw.	2.94	428	150—170	150	...	7	Cables, aerial, partly insulated, partly in bare copper.	60
15. Hamburg ...	650,000	Dec., 1883	Continuous currents with accumulators, two wires.	6 tubulars ...	6·5	250	4, total 1,100 H.P.	6 multipolars, ring, shunt, of 93 kw.	3.68	4,830	105—120	103	15	1·5	Cables in lead in iron pipes.	600
16. Hanover ...	188,000	March 3, 1891	Continuous currents with accumulators, three wires.	3 tubulars ... 1 tubular ...	12 12	181 303	2 double expansion, with condensation, 300 H.P. 1 double expansion, with condensation, 500 H.P.	2 multipolars, shunt, of 200 kw. 1 multipolar, shunt, of 330 kw.	2.136	5,280	220—236	2.110	2.6—8	2.1·5	Cables in lead, armoured and not armoured.	700
17. Cologne ...	298,732	Oct. 1, 1891	Simple alternating currents, no secondary circuit.	6 tubulars ...	6	212	Three compounds, 2 cylinders, 500 H.P. One compound, 1 cylinder, 125 H.P.	3 alternators, 72 poles, of 300 kw., 85 t : m. 1 continuous dynamo of 80 kw.	...	...	2,050	72 & 110	3·6 p. 100 74	1·5 p. 100	Cables, concentric, in lead, armoured, placed in wood troughs.	1,200
18. Copenhagen ...	326,000	March 5, 1892	Continuous currents with accumulators, three wires.	3 tubulars ... 3 tubulars ...	10 10	212 230	2 compounds, 410 H.P. 1 compound, 250 H.P.	4 dynamos, inner poles, of 182 kw. 2 dynamos, inner poles, of 109 kw.	2.136	4,816	220—251	2.110	2.14	2.1·4	Cables in lead, armoured and not armoured, in earth and in channels of concrete.	1,300
19. Lubeck ...	70,000	Nov. 15, 1887	Continuous currents with accumulators, three wires.	3 tubulars ...	10	67	Two machines, 115 H.P. 1 machine, 100 H.P.	6 multipolars, shunt, of 39 kw.	132	2,700	220—230	2.102	2.15	2.3	Cables, partly in lead, partly armoured.	525
20. Mulhouse ...	76,968	March 15, 1888	Continuous currents with accumulators, three wires.	2 tubulars ...	8	195	2 compounds, 150 H.P.	2 multipolars, shunt, of 99 kw.	386	3,270	220—320	2.110	2. 5	2.2	Cables, concentric, with 3 armoured conductors.	392
21. Stettin ...	120,000	Oct. 1, 1889	Continuous currents with accumulators, three wires, and one sub-station.	3 tubulars ... 1 tubular ...	4 4	154 198	1 compound, 100 H.P. 2 compounds, 200 H.P. 1 compound, 300 H.P.	2 multipolars, inner poles, of 30 kw. 4 multipolars, inner poles, of 65 kw. 2 multipolars, inner poles, of 100 kw.	3.130	2,848	224—240	2.110	2.14	2.2	Cables in lead, armoured.	650

B.—*General Information.*

	Altona.	Barmen.	Bremen.	Breslau.	Cassel.	Darmstadt.	Dessau.	Düsseldorf.	Elberfeld.	Gera.	Greifenhagen.	Gummersbach.	Hagen.	Hamburg.	Hanover.	Cologne.	Copenhagen.	Lubeck.	Mulhouse.	Stettin.
1.—Production, Consumption, Sale Price.																				
Production of Electric Energy.																				
Annual in kw. hours	200,357	144,993	...	453,342	179,492	194,559	59,134	484,111	311,000	77,755	20,797	...	...	542,880	452,520	...	417,611	...	184,227	314,870
Daily maximum in kw. hours	2,251	1,015	...	3,452	1,265	1,407	...	3,000	2,484	552·8	...	...	277	3,755	3,227	...	3,157	...	1,110	2,260
Daily minimum in kw. hours	69·2	46·9	...	263	26·3	62·5	...	497·6	209·5	37	...	...	...	430	396	...	...	...	197·8	156
Accumulators.																				
Yield in quantity in per cent.	98	95·2	...	92·1	88·5	92	...	91·3	...	74·7	...	92	90·5	95	96·6	...	92	...	82·3	...
Yield in energy in per cent.	79·8	71·5	...	...	72·9	...	82·1	77·5	...	63·3	...	79·3	78·2	80	79·5	...	74	...	76 3	...
Proportion per cent. of electricity furnished to that distributed	68·6	33 8	...	32·8	74·7	15	51	61·9	...	49·4	...	...	...	30	41	...	33	...	50·3	...
Proportion per cent. of power supplied to normal maximum	...	82·8	...	133·7	131	100	160	101	...	114·5	...	...	...	100	109	...	136	...	111·5	...
Proportion per cent. of power supplied to normal minimum	...	20·7	...	20·1	23	33·7	15	21	...	20·6	...	...	...	35	53	...	13	...	11·9	...
Proportion per cent. of power supplied to normal mean	...	46·6	...	56	67	63·5	43·8	54·3	...	63 8	...	...	...	80	75	...	75	...	57 1	...
Yearly Consumptions.																				
Private consumption in kw. hours ...	...	119,144·8	...	378,674	91,331	...	48,779	...	309,076	53,012	...	...	...	458,030	328,898	307,074	317,501	...	124,644	...
Public consumption in kw. hours ...	...	969·8	...	17,974	11,299	...	...	...	21,375	2,280	...	...	...	55,152	32,296	...	27,715	...	481	...
Various consumptions in kw. hours ...	...	1,911	...	4,228	4,899	...	1,090	...	5,921	...	...	...	..	...	3,919	...	1,607	...	10,912	...
Total consumption in kw. hours	170,830	122,025·6	...	400,876	107,529	159,858	49,869	337,285	336,372	55,292	14,759	...	...	513,182	365,113	307,074	346,823	...	136,037	238,299
Sale Price.																				
For lighting, in centimes, per kw. hour ...	...	9	10·3	9	10	9·2	10·3	11·25	9	10	6·8	...	...	10	9·2	8·75	8·3	9·3	9	9
For various uses, in centimes, per kw. hour	...	6·1	5·1	4·2	5	...	10·3	...	4·5	2·5	5·68	...	...	...	3	3·1	3·1 (summer) 4·2 (winter)	3·4	3·65	5
2.—Power of Installations (Kilowatts). Mean Yearly Utilisation (Hours).																				
Total power of installation, in kw. ...	213·8	402·9	...	803·7	270·6	435·6	195·9	859·9	587	149·9	28·5	...	84·4	685·2	738·9	833·1	817·6	298·1	502·4	519·8
Mean yearly utilisation in hours	799	302	...	498	397	367	254	392	573	368	517	...	...	748	494	368	424	...	270	458
Warehouses ... ... kilowatts	74·4	74·9	...	343 8	95·3	99·3	21·6	200	230·4	83·2	5·7	...	27·3	244·5	325 6	300·7	...	75·1	83 5	163 3
hours ...	...	503	...	461	471	...	314	418	...	...	...	...	...	581	476	413	343	600	307	...
Hotels, restaurants, cafés ... kilowatts	36·4	30·5	...	126·4	52·6	14·7	11·1	64·6	65·1	24·1	1·1	...	15·1	222·6	122·8	175 2	...	23·5	39 3	33·5
hours ...	...	526	...	82·4	396	...	436	788	...	...	...	...	...	546	700	550	202	576	555	...
Banks and offices ... ... kilowatts	28·3	35·3	...	98·6	36·2	33·8	3·8	3·3	90·6	6·1	2·1	...	1·4	155·2	60·3	130·8	...	103·2	44·4	126·9
hours ...	...	423	...	411	339	...	215	343	...	...	...	...	...	646	566	420	303	293	215	...
Theatres, &c. ... ... kilowatts	4·2	65·2	...	163·5	15·2	167·4	53·4	382	33·6	11·6	...	...	...	70·9	30·2	111·8	...	13 7	45·6	45·1
hours ...	...	186	...	337	127	...	420	452	...	...	...	...	...	379	430	268	121	330	196	...
Houses ... ... kilowatts	10·7	87·1	...	13·6	20·9	70·8	103·6	167·9	49·1	16·2	7·6	...	37·2	50·8	43 4	79·1	...	22·5	156 8	94·7
hours ...	...	166	...	267	260	...	85	145	...	...	...	...	...	240	190	122	113	255	135	...
Churches, schools, museums kilowatts	...	51·1	...	16·6	5·1	...	0·3	...	23·1	...	3·7	...	...	...	36·9	4·8	...	0·3	14·6	...
hours ...	...	154	...	127	21	...	94	...	...	...	...	...	...	...	259	250	167	167	75	...
Hospitals ... ... kilowatts	24·4	...	...	...	...	14	...	...	14·5	...	...	...	0·2	3 6	...	2·8	...	...	5·2	...
hours ...	...	...	...	...	...	...	...	...	...	...	...	...	...	133	...	160	167	...	92	...
Factories, workshops, stores kilowatts	16·2	31·9	...	0·4	23·4	35·6	0·3	16·2	70·2	...	1·5	...	2·8	5·6	69·5	20 8	...	26	79 9	22·2
hours ...	...	325	...	327	216	...	350	432	...	...	...	...	...	573	263	585	220	165	374	...
Streets ... ... kilowatts	8·2	4·4	...	8·5	7·1	...	...	3·6	2 6	1·2	5·5	...	...	28 8	20·7	...	...	17 3	0·1	...
hours ...	...	220	...	2,150	1,600	...	...	2,097	...	...	...	...	...	1,915	1,558	...	1,327	649	4,374	...
Motors ... ... kilowatts	2·7	9·4	...	12·8	11·1	...	4·6	22·3	2·4	...	0·9	...	...	1·2	23 8	...	...	13·1	23	25·1
hours ...	...	203	...	268	445	...	237	87	...	...	...	...	...	...	165	...	65	71	472	...
Various ... ... kilowatts	8·4	12·8	...	19·5	1·75	...	1·8	...	5 4	7·3	0·5	...	0·4	3·2	5·7	6 9	...	3·4	9·8	9·8
hours ...	...	446	...	865	3,044	...	789	...	...	...	...	...	...	...	881	4,085	...	1,165	468	...

Association of Representatives of Central Stations has been drawn up, from a different point of view, and is distinguished by the abundance supplied of interesting documents of all kinds. This society meets yearly, and fixes the bases of the information to be published concerning central stations. The idea of this association is excellent, and we must strongly congratulate the engineers by whom it has been initiated.

The documents already published relate to the installation and the working of central stations. We have collected together in Table II. all data which we have been able to find in the document in question. The table is sub-divided into two others: the first, A, relating to production, and the second, B, to working. This second table is, in turn, subdivided into two parts: the first containing the figures concerning production, consumption, and sale price, and the second to the classification of the consumers and the time of utilisation.

The discounts allowed by the companies on the sale prices, shown in the tables, vary greatly. To cite some instances, at Barmen they allow for lighting 4 to 10 per cent. on a yearly consumption of 250 to 7,500 francs. At Bremen the discounts range from 5 to 20 per cent. on accounts of 625 to 18,750 francs yearly. In some towns discounts of 5 to 20 per cent. are allowed for quantities of electricity of from 2,000 to 15,000 ampère-hours.

We mention, likewise, the town of Dessau, which allows the extraordinary discount of 30 per cent. from May 1st to October 1st; that is at the season when the consumption for lighting is greatly limited. As to the use of electricity for various purposes, they are most variable, ranging from 4 to 30 per cent.

It is to be desired that the managers of central stations in France—or, at least, in Paris—would publish from time to time similar statistics.

MECHANICAL STOKING.

With a view to testing the merits of mechanical stoking and bituminous coals as against Welsh coal hand-fired, the City of London Electric Lighting Company have had trials made at the Bankside Station, S.E. The hand-firing test was made on April 26th last, and the mechanical stoking test on June 4th with Vicars's mechanical stoker. The boilers are of the water-tube variety, and the two fuels tested were Nixon's navigation and rough bituminous slack, at 16s. and 10s. per ton respectively.

The bituminous test was for six hours only, whereas the test hand-firing was of nine hours' duration.

The following table gives a summary of the results, from which it appears that the evaporation per pound of coal from and at 212° was 10½ lbs. with the Welsh coal and fully 10¾ lbs. with the bituminous, and the latter showed a saving in money cost of nearly 40 per cent., the duty being not merely greater per unit of cost, but also per unit of weight of the bituminous fuel, though a very much greater percentage of ash and clinker was produced than came from Nixon's navigation. A six hours' test is rather short, and it may be argued that the results are really too favourable to the bituminous coal. At the same time they may be equally as unfavourable, and in any case the margin is too great for the results to be seriously impugned, and affords another argument in favour of bituminous fuels when these are the cheapest to buy.

	Hand firing.	Vicars's mechanical stoker.
Date of trial	April 26th.	June 4th.
Duration	9 hours.	6 hours.
Fuel	Nixon's navigation.	Bituminous slack.
Price	16s. per ton.	10s. per ton.
Fuel	13,664 lbs.	9,184 lbs.
Per cent of ash, &c.	3·9 per cent.	11·1 per cent.
Water evaporated	118,535 lbs.	82,100 lbs.
Evaporation per hour ...	13,170 lbs.	13,683 lbs.
Steam pressure	145·9 lbs.	157·5 lbs.
Evaporation per pound of coal from and at 212°	10·50 lbs.	10·78 lbs.
Ditto per lb. of combustible	10·93 lbs.	12·12 lbs.
Cost per 500 gallons	40·8d.	24·8d.
Temperature in flue	411·4° F.	453° F.

We are indebted to Mr. Geo. S. Howatson for the above results of the trials, which have resulted in Mr. Howatson securing the order for the mechanical stokers at the Bankside station.

The slight additional average flue temperature secured with the bituminous coal is probably due to the cooling effect of the open door when hand firing; but the general result of the trial is very similar to what may usually be expected, and proves that one fuel is practically as good as another when rational care is used in its consumption, and that there is no excuse for again raising the long exploded bogey of the impossibility of utilising the hydrogens. Any further attempts in this direction may very well be held to prove rather the lack of information on the part of those making such claims. Upon enquiring from Mr. Howatson as to whether there was any smoke with the bituminous coals, he informs us that he has added a length of brick arch above the first portion of the fire, and this is perfectly successful in securing smokeless combustion—a condition which we would add has been insisted upon in our columns more than once.

NEW PATENTS -1894.

11,261. "Improvements in oil engines." J. H. Hamilton. Dated June 11th.

11,276. "Improvements in and relating to electric incandescent lamps." R. Langhans. Dated June 11th.

11,280. "Improvements in jointing electric conductors." W. Geipel. Dated June 11th.

11,285. "Variable speed and power gear." L. L. Grouse. Dated June 11th.

11,286. "Improvements in electric arc lamps." H. C. L. Holden. Dated June 11th.

11,301. "Improvements in variable speed gearing." W. P. Thompson. (Communicated by W. Harrisson, dit Monniot, France.) Dated June 11th.

11,303. "Improvements in level commutators." E. Dragoumis. Dated June 11th.

11,312. "Improvements in electric accumulators or secondary batteries." H. H. Lake. (Communicated by La Société Electrogénique, France.) Dated June 11th.

11,320. "Improvements relating to telegraphic and telephonic transmission." H. H. Lake. (Communicated by M. I. Pupin, United States.) Dated June 11th. (*Complete.*)

11,323. "Improvements in apparatus for the automatic transmission of signals through telegraph lines and cables." A. Muirhead and A. Fraser. Dated June 11th.

11,338. "System of electric signalling." C. M. Houghton. (Communicated by L. F. C. Rich, United States.) Dated June 11th.

11,364. "Improvements in dynamo-electric machines." W. Lowrie. Dated June 12th.

11,365. "Improvements in gas and oil motor engines." J. P Lea. Dated June 12th.

11,418. "Improvements in telephone transmitters." J. E. Kingsbury. (Communicated by the Western Electric Company, United States.) Dated June 12th. (*Complete.*)

11,439. "Improved electric indicator." H. J. Wagg. Dated June 13th.

11,452. "Improvements in connectors for conductors used with electrical apparatus." R. E. B. Crompton and H. J. Dowsing. Dated June 13th.

11,483. "Improvements relating to the generation of electricity." J. E. Liardet. Dated June 13th.

11,559. "Improvements in magneto-electric motors." H. Ludeke, E. L. A. Ludeke, A. J. Thorman, E. de Bunsen, and E. M. Hore. Dated June 14th.

11,560. "Improved isolating or non-conducting material." C. A. Peters. Dated June 14th.

11,587. "Improvements in the process of and apparatus for the electrolytic decomposition of solutions, and for the immediate separation therefrom of the liquid or dissolved electrolytic products." L. P. Hulin. Dated June 14th. [Date applied for under Patents, &c., Act, 1883, Section 103, November 25th, 1893, being date of application in France.]

11,601. "Improvement in printing telegraph instruments." O. L. Kleber. Dated June 14th. (*Complete.*)

11,606. "Improvement in separators for electric storage cells." F. R. Davenport. Dated June 15th.

11,613. "An electrical minnow for fishing purposes." H. W. Rowland. Dated June 15th.

11,628. "Improvements in the mode of and means for suspending electric lamps, lanterns, shades, and other such articles." F. Hewitt. Dated June 15th.

11,664. "An improved method, means, or process of producing caustic soda and chlorine gas, or caustic potash and chlorine gas, by the electrolysis of common salt in solution or chloride of potassium in solution." T. Drake. Dated June 16th. (*Complete.*)

11,684. "Improvements in and connected with electrical safety fuses." A. Marr. Dated June 16th.

11,701. "Improvements in electric fire alarms." G. R. Neilson, and A. C. Brown. Dated June 16th.

11,713. "Improvements in or connected with telephones." J. Goulding. Dated June 16th.

11,722. "A new or improved water motor." G. R. Rollason, C. A. Rollason, and W. H. Fletcher. Dated June 16th.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1893.

4,952. "Improvements in electrical relays and measuring instruments." W. S. Smith and W. P. Granville. Dated March 7th. The inventors rigidly attach two light coils of insulated wires, connected in series, one to each end of an arm, which is pivoted at its centre—a ring of soft iron which is concentric with the axis of the arm is made to pass through each coil without touching it, so that the arm with the coils on its ends may swing freely—or, instead of two coils, one large coil embracing the whole diameter of the ring might be used. They also, for the most part, surround each of the two coils by the pole of a magnet, one coil with one pole, say, north, the other with the other, that is south; the magnet or magnets, as well as the iron ring, are rigidly attached to the base board.

5,337. "Improvements in conductors for electric railways." J. A. Ewing. Dated March 11th. Consists in using insulated conductors and splitting up either the positive or the negative conductor, or both, in two or more parts, and placing these parallel to each other in such relative positions that the resultant positive current or axis of the positive conducting system coincides with the resultant negative current or axis of the negative conducting system. 4 claims.

5,505. "Improvements in apparatus for moulding the bodies of electric switches, bell pushes, ceiling roses, and other like articles in china and earthenware." H. Watkin. Dated March 14th. Claims:—1. The peculiar combinations and arrangements of parts forming upper and lower dies for moulding the bodies of electric switches, bell pushes, ceiling roses, and other like articles in china and earthenware. 2. In apparatus for moulding the bodies of electric switches, bell pushes, ceiling roses, and other like articles in china or earthenware, the construction of one of the dies with a removable bottom or die piece having the screw thread formed therein, substantially as herein shown and described, so that by the use of a number of such removable die pieces, with a single press, a greater quantity of work is enabled to be produced thereby than in presses where such removable die pieces are not employed.

6,813. "Improvements in electrical arc lamps." F. Bryan. Dated April 1st. Consists in an improved form of mechanism for controlling the feed of the carbon electrodes of electric arc lamps. 7 claims.

6,933. "Improvements in or relating to the working of signals and locking of points electrically at railway junctions." The Automatic Electric Railway Signal Company, Ltd., and E. Blakey. Dated April 4th. The points lever, which is, as usual, under manual control, is kept locked in either of its positions by suitable means operated electrically by treadles operating contact makers or contact breakers, which treadles are so situated as to be actuated by a passing train. These treadles or contact devices are arranged in such a manner that the first one operated by the passing train breaks the electric circuit and causes the points lever to be held in whichever position it may happen to be in at the moment, and will prevent said lever from being again moved until the train operates the second treadle or contact maker, thereby completing the electric circuit and releasing the points lever. 3 claims.

6,965. "Improvements in and relating to electric furnaces." R. Urbanitzky and A. Fellner. Dated April 4th. The improved furnace is specially useful for melting iron ores for the manufacture of steel, and for reducing manganese, aluminium oxide, and other metallic oxides by the aid of the electric arc. 2 claims.

3,573. "Improvements relating to the extraction of metals by means of electricity, and to apparatus therefor." E. Taussig. Dated February 17th. Relates to a process for melting and casting in a chamber from which the air has been withdrawn, the electric current being conducted directly through the granular or pulverulent materials placed between metallic electrodes having large surfaces, and the heat for the melting being produced in consequence of the great resistances to the passage of the current within the disintegrated material to be melted. 3 claims.

3,477. "Improvements in constructing and connecting galvanic elements." H. Nehmer. Dated February 16th. Claims:—1. A cylindrical zinc vessel with a round carbon rod in the centre. 2. A cylindrical zinc vessel to which is fastened a fork-shaped metal spring.

6,470. "Improvements in electrical measuring instruments." B. J. B. Mills. (A communication from A. E. Kennelly, of America.) Dated March 27th. Relates to electrical measuring instruments of that class employing a magnet of constant strength, between the poles of which is pivoted an armature controlling a pointer movable over a graduated scale. 1 claim.

7,190. "Improvements in the manufacture of the magnetic parts of electrical apparatus." A. G. New. Dated April 7th. Claims:—1. The improvements in the manufacture of cores for choking coils and the magnetic parts of electrical apparatus consisting in forming same of iron filings, scraps or the like, and a binding material, such as plaster of Paris. 2. The improved cores or magnetic parts of electrical apparatus composed of iron filings, scrap or the like, and a binding material, such as plaster of Paris. 3. The improvements in the manufacture of the magnetic parts of electrical apparatus, substantially as described.

8,087. "Improvements in arc electric lamps." J. Brockie. Dated April 21st. The inventor joints both the cores, that of the main and that of the shunt solenoid, to a horizontal bar, to the end of which, farthest from the shunt core, he joints a vertical rod, the lower end of which hooks under the clutch washer that embraces the holder of the upper carbon. While the shunt core retains one end of the bar in position, the main core lifts the middle of the bar, and the vertical rod at its end, until the normal voltage between the carbons is obtained, after which the shunt core moves the bar as a lever on the pivot, by which it is jointed to the main core, thus depressing the vertical rod and releasing the clutch washer to permit feed of the carbon. 2 claims.

24,392. "Improvements in and connected with electric motors for vehicles." C. F. Winkler. Dated December 19th. Relates more particularly to the construction of the motor, which comprises two armatures, secured respectively on two axles of a car, and a single field magnet in which there is but a single magnetic circuit which includes both armatures. 8 claims.

9,478. "Improvements in insulators for electric wires." H. H. Lake. (Communicated from abroad by Hartmann and Braun, of Germany.) Dated May 11th. Consists of a ring of porcelain, glass, hard rubber, or the like, through the centre of which ring the wire is passed, that is to say, any required number of rings can be threaded on to the wire before beginning to fix, the outer circumference of this insulating ring is provided with a groove which fits into a snap or spring hook. 6 claims.

10,147. "Methods of, and means for, applying electricity to the human body." F. Dowling. Dated May 23rd. The object of the invention is to provide improved electric appliances to be attached to or form part of belts, corsets, or under-garments, or which may be worn independently of either by persons of either sex, and by means of which electricity may be obtained for curative or other purposes in a simple manner. 3 claims.

19,967. "Improvements in secondary electric batteries." W. Petschel. Dated October 23rd. Relates to a secondary electric battery, of which the electrodes contain as active material small pieces of very thin (about ¼ mm.) lead plate, corroded according to Plante's process by charging and discharging. 4 claims.

21,630. "Improvements in telegraphy." P. B. Delany. Dated November 13th. The object of the invention is to provide a mechanical system to take the place of hand transmission over ocean cables and long and difficult land lines. 14 claims.

22,253. "Automatic railway electric signals." C. H. Bradrick and B. A. Karr. Dated November 21st. Relates to that class of electric signals for railways which employ the main railway track as one line conductor, insulated central rails as the other line conductor, and a trolley carried by the car and running on the central track, and wherein each engine carries an alarm, a source of electricity and proper connections for making a complete half circuit, the central insulated conductors being divided into sections, and the circuit through both engines being completed when they arrive upon the same section. 4 claims.

22,765. "Multiple telegraphy." J. McCraith. Dated November 28th. Consists of a metallic disc, drum, or cylinder faced with non-conducting material, except in part, or parts, which are left good conductors of electricity. This disc, drum, or cylinder is in electrical contact with end of telegraph wire or cable—one such at each end of wire or cable. A series of insulated levers so arranged round each disc, drum, or cylinder that one end of each is in constant contact with the surface of the disc, drum, or cylinder, and the other end is in electrical contact with the key or receiver of a telegraph instrument. 1 claim.

22,858. "Improvements in electric lighting and extinguishing apparatus for gas burners." E. Orling. Dated November 28th. Comprises an electro-magnetic armature, which when attracted opens a spark generating contact placed near the gas burner, and at the same time, by means of a pawl, turns the plug of the gas cock, which is provided with a ratchet wheel. 6 claims.

22,956. "New improved electro-positive galvanic battery electrodes." C. A. J. H. Schroeder and H. E. R. Schroeder. Dated November 29th. An electro-positive electrode of excellent quality for galvanic batteries is obtained by melting together: From 50 to 99 parts by weight of zinc; from 0·04 to 12 parts by weight of lead; from 0·001 to 6 parts by weight of aluminium. The exact proportions, however, have to be taken according to the type of battery in which the electrodes are going to be used, that is to say, in a single fluid battery the quantity of lead and aluminium have to be larger than in a double fluid battery. 6 claims.

23,424. "Improvements in incandescent electric lamps." H. Green. Dated December 5th. The object of the invention is to provide in an incandescent electric lamp, a constantly active mechanical agent adapted and tending to positively force the stopper of the lamp into the neck of the bulb and prevent the vitiation of the vacuum in the lamp by leakage around the stopper. 3 claims.

24,946. "Improvements in coverings for electric wires." F. S. Randall, E. Packard, J. Robinson, and W. J. Chaninel. Dated December 28th. Consists in wrapping or otherwise covering the wire with raw cotton in bulk. 1 claim.

24,948. "A time electric switch." E. C. De Segundo and W. Derham. Dated December 28th. Relates to an electric switch combined with clockwork, so that at the lapse of a predetermined time after contact is made by it, contact is suddenly and completely broken. 1 claim.

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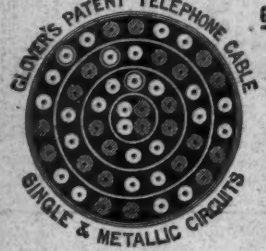

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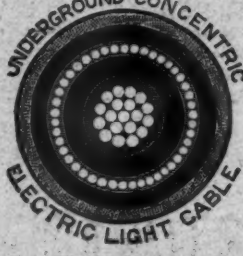

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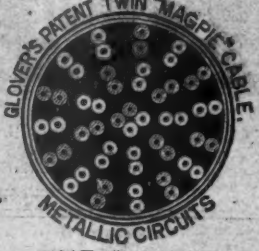

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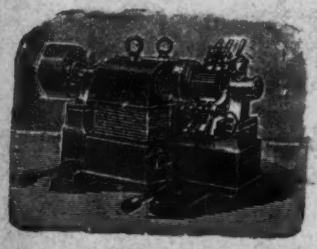

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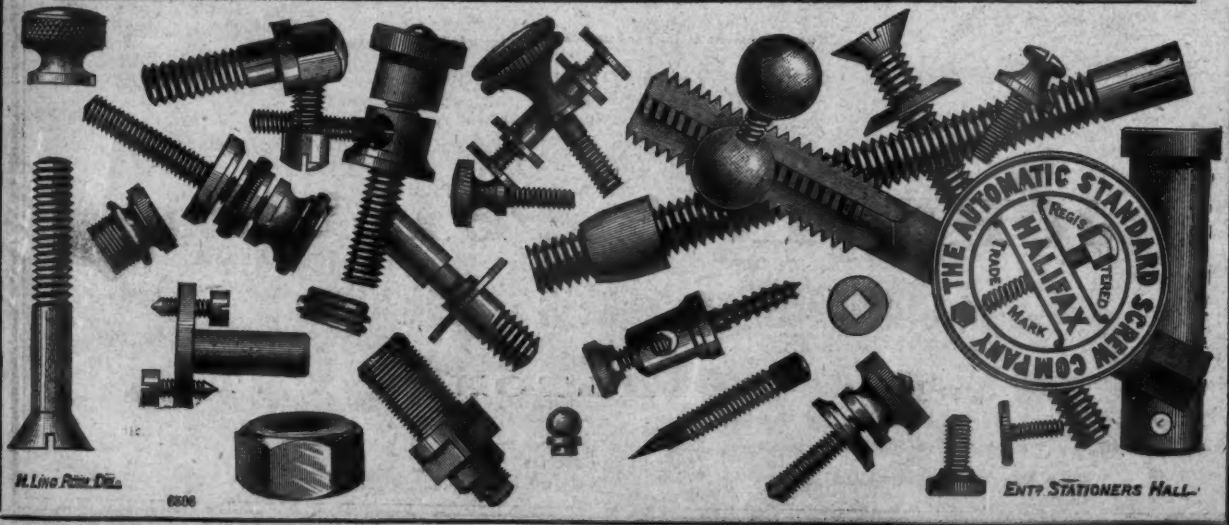

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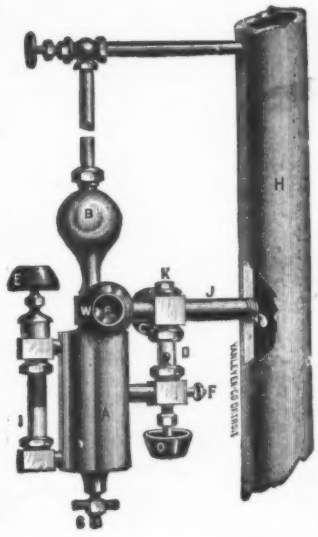

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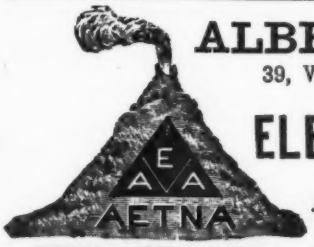

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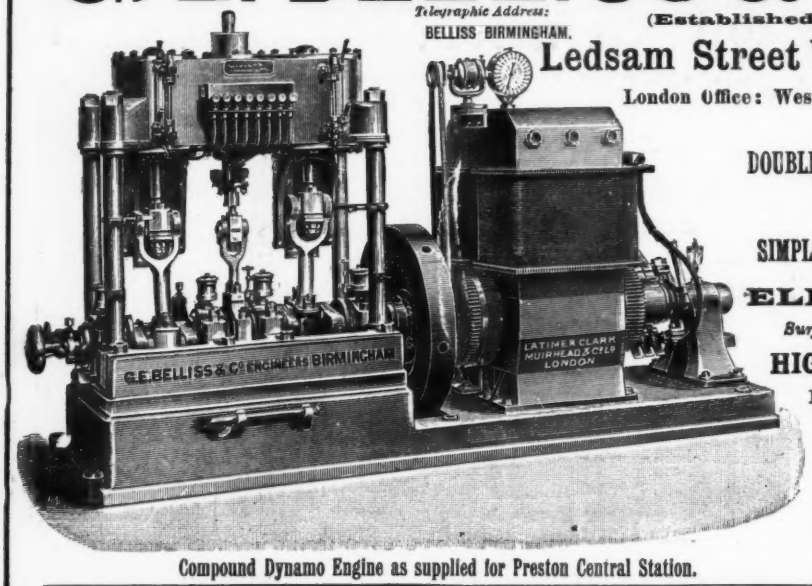

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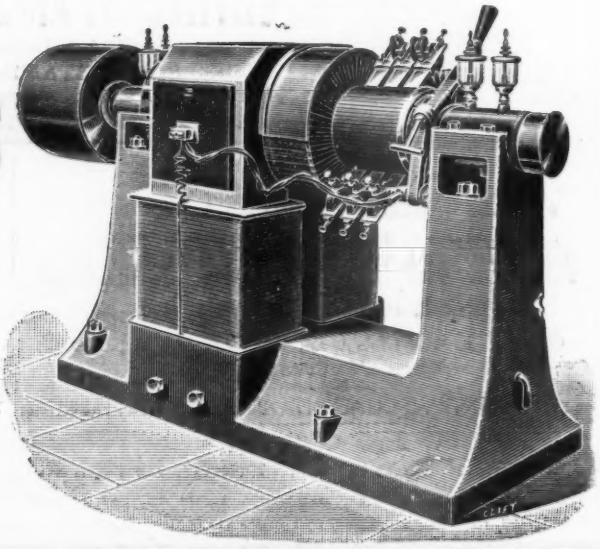

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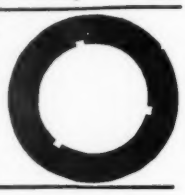

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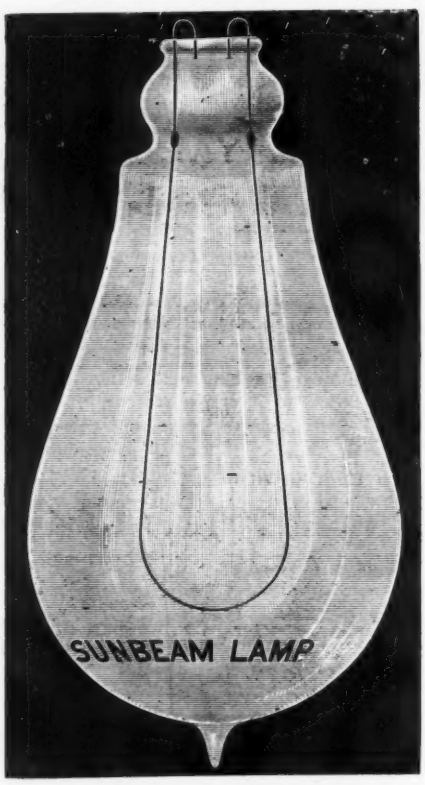

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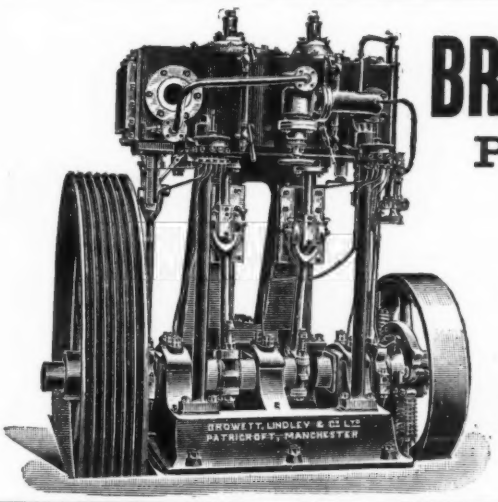

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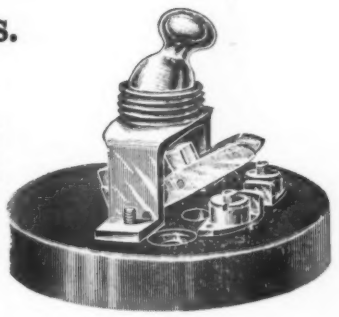

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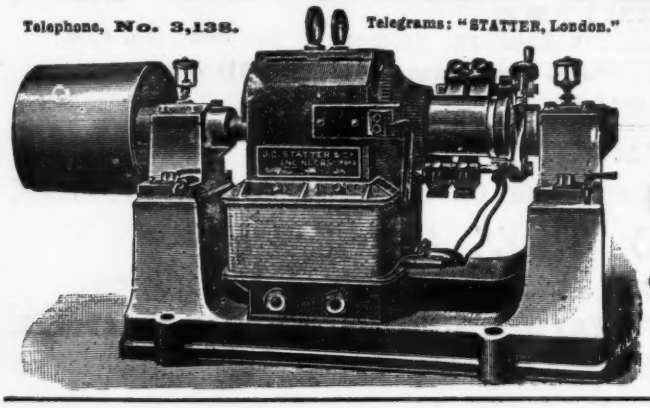

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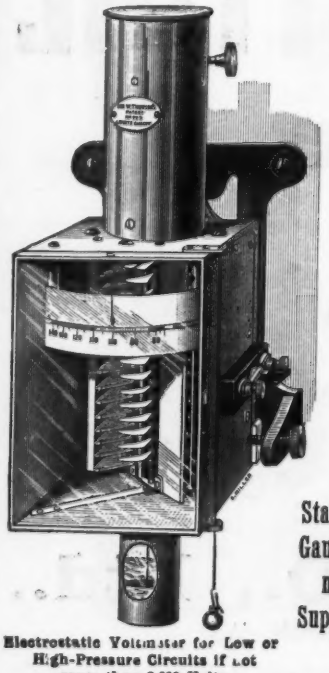

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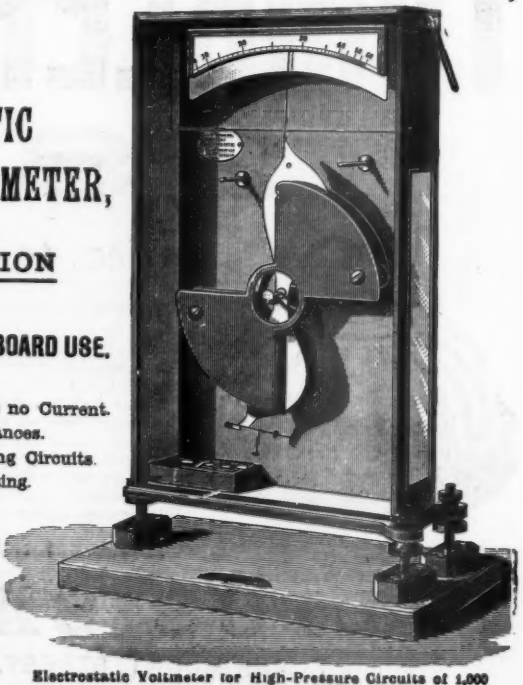

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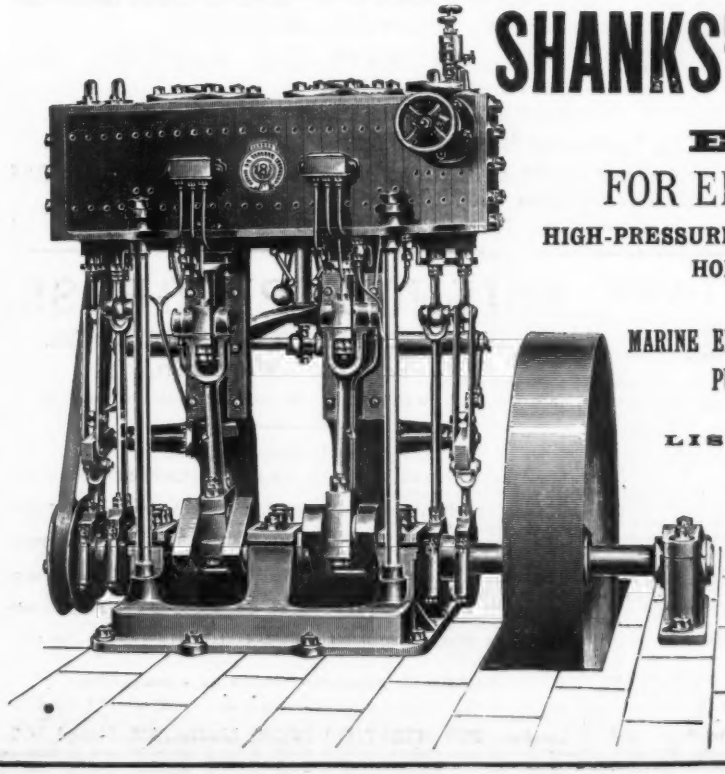

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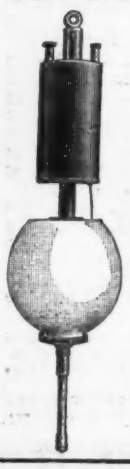

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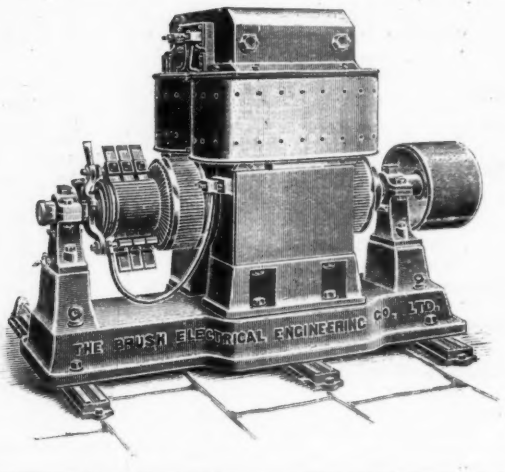

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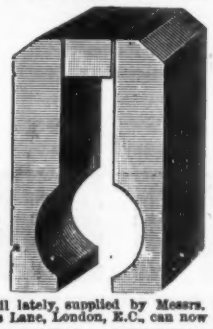

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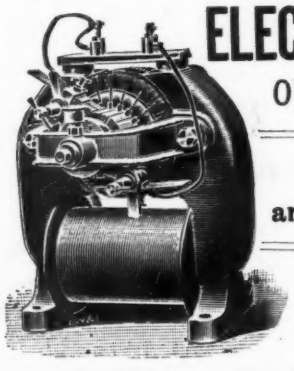

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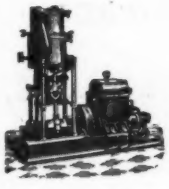

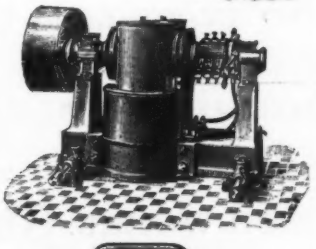

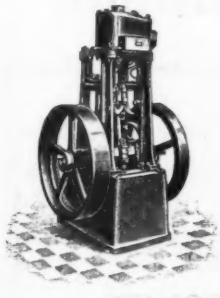

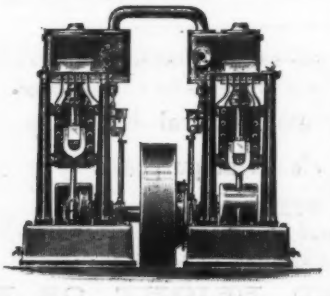

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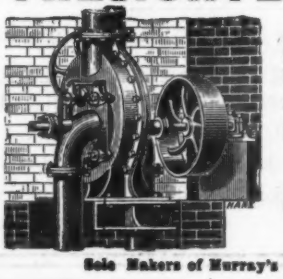

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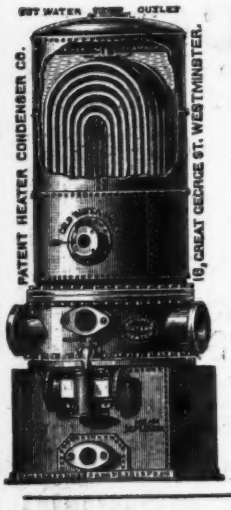

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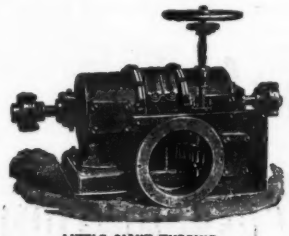

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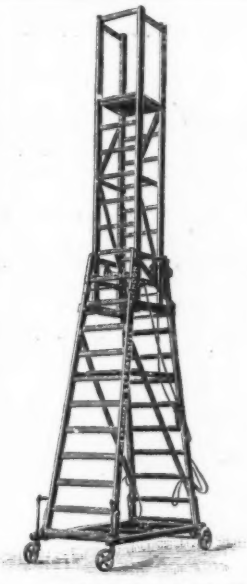

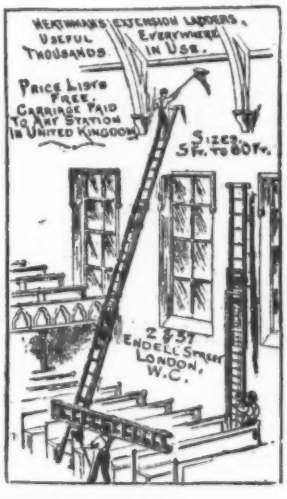
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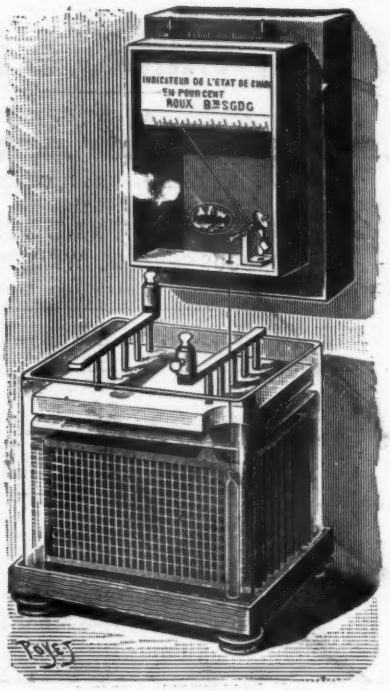

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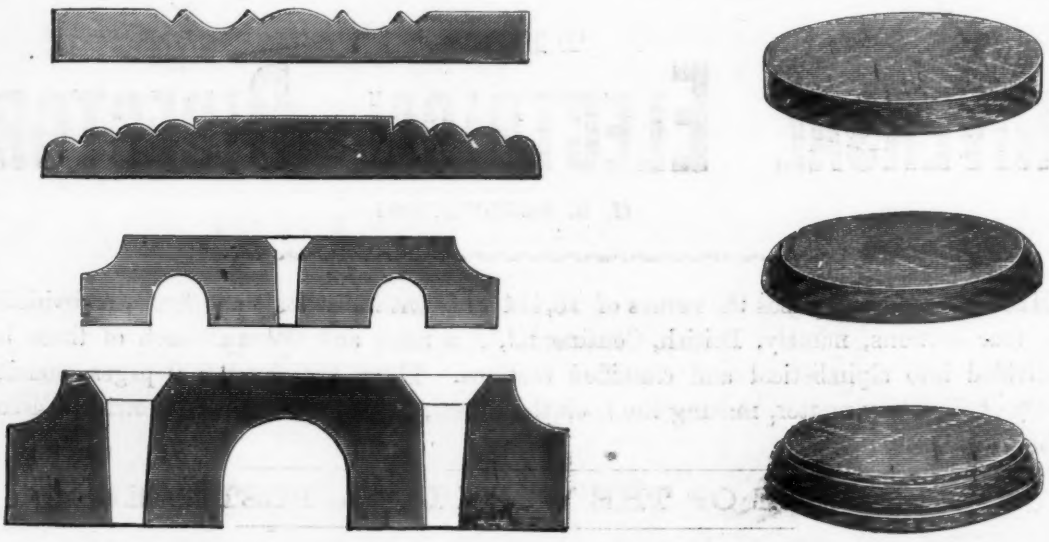

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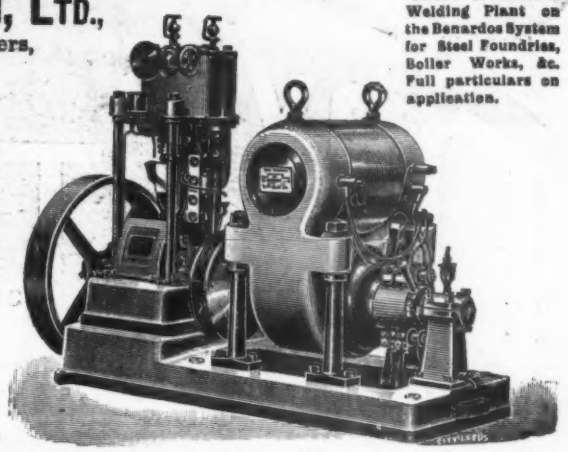

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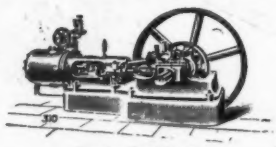

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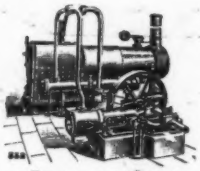

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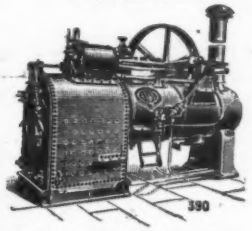

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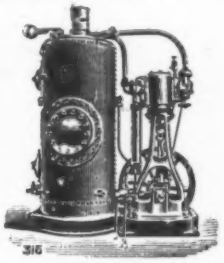

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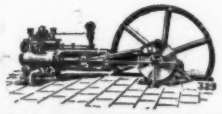

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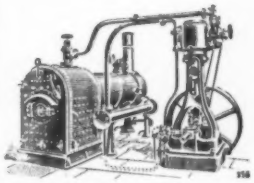

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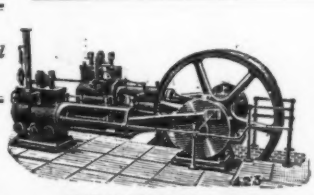

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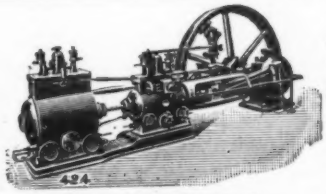

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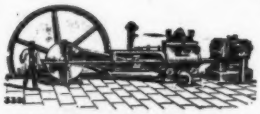

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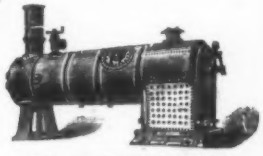

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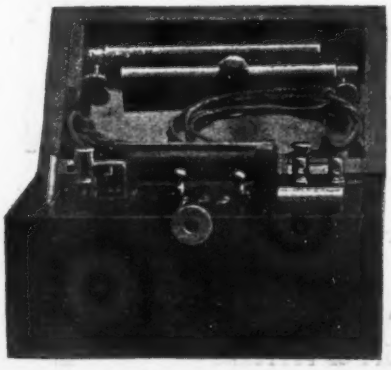

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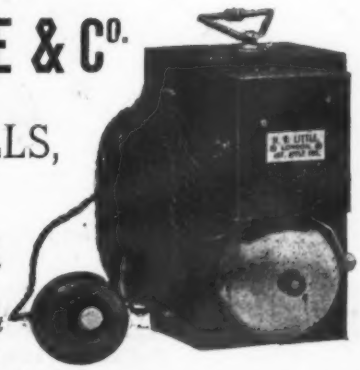

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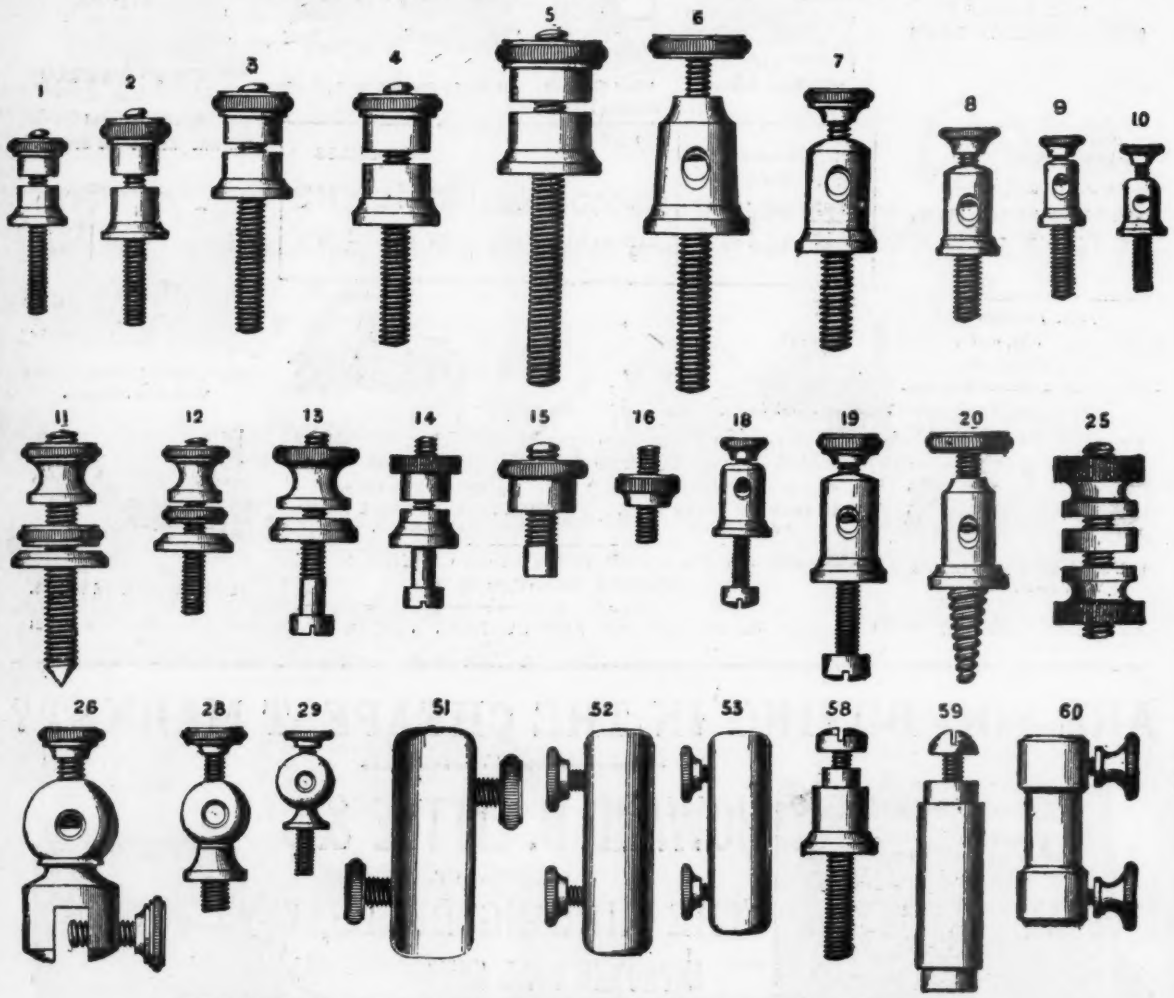

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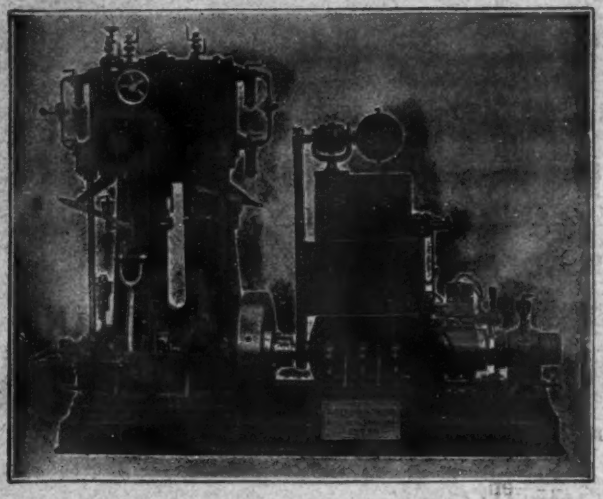

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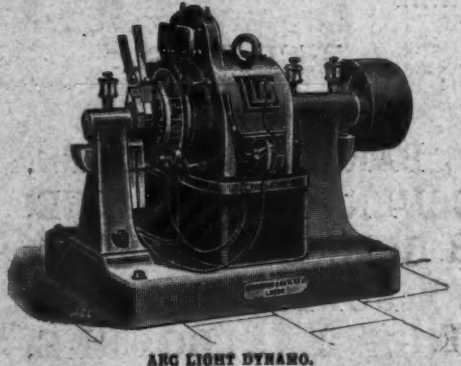

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